BEFORE THE
NATURAL RESOURCES COMMISSION
OF THE
STATE OF INDIANA

IN THE MATTER OF:

	)	**Administrative Cause**
RUFFED GROUSE AND TURKEY	)	**Number 09-165D**
	)	**(LSA Document #09-984(F))**

REPORT OF PUBLIC HEARING AND COMMENTS, AND RECOMMENDATION REGARDING FINAL ADOPTION

1. RULE PROCESSING

The Department, through its Division of Fish and Wildlife, proposed the rule amendments to 312 IAC 9-4-10 pertaining to ruffed grouse and 312 IAC 9-4-11 pertaining to wild turkeys. The amendments to 312 IAC 9-4-10 propose to reduce the length of the ruffed grouse hunting season on public land and proposed amendments to 312 IAC 9-4-11 will modify the dates of the fall season for hunting wild turkeys, add counties where wild turkeys may be hunted during the fall season. The amendments to 312 IAC 9-4-11 will also require hunters to wear hunter orange during the portion of the fall wild turkey season that coincides with deer muzzleloader season.

The Natural Resources Commission *(NRC)* gave preliminary adoption to the rule package on November 17, 2009.

A "Notice of Intent" to adopt the proposed rule amendment was posted to the INDIANA REGISTER database website as 20091216-IR-312090984NIA on December 16, 2009. The notice identified Linnea Petercheff, Department of Natural Resources, Division of Fish and Wildlife, as the "small business regulatory coordinator" for purposes of Indiana Code § 4-22-2-28.1.

Fiscal analyses were prepared in association with the proposed rule package. The Department determined that the proposed amendments to 312 IAC 9-4-10 will have no fiscal impacts to the agency and will impose no costs or requirements upon regulated entities or small businesses. The proposed amendments to 312 IAC 9-4-11 are expected to general significant positive fiscal impacts to the agency derived from increases in the sale of licenses for the fall wild turkey hunting season. The proposed amendments to 312 IAC 9-4-11 will impose no costs or requirements upon regulated entities or small businesses.

The fiscal analyses, a copy of the proposed rule language and a copy of the posted Notice of Intent were submitted to the Office of Management and Budget on December 29, 2009. In a letter dated May 13, 2010, Christopher A. Ruhl, Director, Office of Management and Budget, recommended that the proposed rule amendments be approved.

The NRC Division of Hearings submitted the rule proposal to the Legislative Services Agency *(LSA)* along with the "Statement Concerning Rules Affecting Small Business" on May 14, 2010. The Notice of Public Hearing was submitted to LSA on May 17, 2010. The Notice of Public Hearing, along with the Economic Impact Statement and the text of the proposed rule was posted to the INDIANA REGISTER database website on June 2, 2010 as 20100602-IR-312090984PHA. Following receipt of an "Authorization to Proceed" from LSA on May 17, 2010, the NRC Division of Hearings also caused a Notice of Public Hearing to be published by the Indianapolis Newspapers, a newspaper of general circulation in Marion County Indiana, on May 21, 2010. In addition, the notice of the public hearing and a summary of the proposed rule changes were published on the Commission's web-based electronic calendar.

2. REPORT OF PUBLIC HEARING AND COMMENTS

a) Public Hearing Comments

The public hearing was conducted as scheduled on June 24, 2010 at 6:00 p.m. at the Marion County Public Library, Wayne Branch, 198 S. Girls School Road, Indianapolis, Indiana. Hearing Officer, Sandra Jensen, was present along with Linnea Petercheff of the Department's Division of Fish and Wildlife. Eleven members of the public appeared and offered comments that are summarized at Exhibit A.

b) Comments Received Outside Public Hearing

Written public comments were received from approximately November 17, 2010 until June 25, 2010. These comments have been attached to this report as Exhibit B.

c) Response by the Department of Natural Resources

The Department of Natural Resources responded to the public comments on June 28, 2010. A copy of the Department's response is attached as Exhibit C.

3. RECOMMENDATION

a) Ruffed Grouse, 312 IAC 9-4-10

Nearly every individual who participated in the public comment period relating to the proposed amendments to 312 IAC 9-4-10 acknowledged that ruffed grouse populations are tremendously low. It was also nearly unanimous amongst those who commented that the lack of ruffed grouse habitat is the primary contributing factor in the population declines that have occurred since the 1980s. The Department, in its response to the public comments, acknowledges the accuracy of these comments.

The individuals who offered comments pertaining to ruffed grouse almost uniformly focused upon what they characterized as the mismanagement of forests and public lands by the Department as well as the U.S. Forest Service, the U.S. Fish and Wildlife Service and other governmental entities and agencies. These individuals expressed their opinions that these governmental entities that have the authority and the responsibility to manage public lands have ignored the habitat needs of ruffed grouse and other species that need young forest growth for survival. Many of those individuals offering comments reflected upon meetings between themselves and the Department in 2008. These comments express concern that the Department, particularly, has failed to act upon numerous recommendations that resulted from those meetings.

While the sentiment regarding the mismanagement of public land resources is generally uniform there exists a somewhat even division as to the public's actual support or opposition to the Department's proposed rule.

The individuals who oppose the rule proposal characterize the shortened ruffed grouse season on public lands as a penalty being placed upon the hunting community for the actions, or inactions, of the Department and other governmental agencies that allowed the ruffed grouse populations to dwindle to all time lows.

Those individuals who support the Department's proposed rule amendment similarly agree that the Department and other governmental agencies "dropped the ball" in their management of ruffed grouse habitat but recognize that despite the cause, the situation will improve only through a concerted effort that includes a sacrifice on the part of hunters. They realize that conservation of remaining populations is necessary while firmly emphasizing that the Department and other governmental entities with forest and property management responsibilities must do their part. They acknowledge that the Department's Division of Forestry has completed some limited clear-cutting of timber, which will create the young forest resources necessary for this species. The Department's Division of Fish and Wildlife similarly acknowledges that it "must continue to advocate the need for timber harvests to increase habitat for depressed ruffed grouse populations..."

The individuals who support the Department's proposal have requested that the proposed amendment to 312 IAC 9-4-10 be placed under a five (5) year sunset provision. Such a sunset requirement would prompt a full re-evaluation to begin after this rule amendment had been in place for approximately three (3) years. The hearing officer can appreciate the hunting community's desire to know whether their sacrifice is having a positive effect upon the grouse populations. The Department's response did not address this request. It is the hearing officer belief that the inclusion of a sunset provision in response to written comments is acceptable. However, the inclusion of a sunset provision is viewed by the hearing officer as a matter of public policy best left to the discretion of the Natural Resources Commission.

b) Wild Turkey, 312 IAC 9-4-11

The greatest number of comments relating to the proposed amendments to the wild turkey season favor the amendments as proposed. There were a small number of individuals who expressed concerns about the expansion of the turkey firearms season into the deer archery season and others who suggested that the archery season for wild turkeys should coincide with the early deer archery season. Each of the individuals offering these comments provided a reasonable explanation for their viewpoints. However, there is nothing contained within these comments that reflects a need for any revision to be made to the seasons as proposed by the Department.

c) Revisions

Through the final review of the published rule language two crucial clerical errors were identified. The first pertains to the reference to "subsection (b)(2)" within 312 IAC 9-4-11(b)(2)(A), which should have been a reference to "subsection (b)(1)." The second error is in a citation to "312 IAC 9-3-4(c)(2)" at 312 IAC 9-4-11(b)(2)(B), which should have been a citation to "312 IAC 9-3-4(e). The correction of these clerical errors will allow the citations to appropriately correlate to the language of the particular subsections and will not change the meaning of these subsections. These revisions have been made to the rule language as set forth at Exhibit D.

The hearing officer recommends that the rule language as set forth at Exhibit D, be granted final adoption.

Dated: June 29, 2010

Sandra L. Jensen
Hearing Officer

"Exhibit A"

Public Hearing Comments

Mike Bandos, Columbus, Indiana
Bandos questioned whether the proposed limit on the hunting of ruffed grouse was simply "window dressing" given the lack of habitat enhancement that has been done in the past seven (7) years. He noted that some things in the DNR Division of Forestry report, particularly references to increased clear cutting, seemed "encouraging" in terms of helping grouse habitat. However, he stated that these things do not come out "clearly" in the report. He also inquired whether there was any discussion of trapping and releasing ruffed grouse.

Mitch Marcus noted that the Division of Fish & Wildlife could not speak for the Department as a whole. However, he acknowledged that through the grouse summit, an agency wide meeting with stakeholders including bird hunting and conservation groups, there were recommendations for habitat enhancement. Marcus indicated his belief that the Division of Forestry's activities will help in that endeavor. He indicated that the Division of Fish & Wildlife and the Department cannot do this alone but, instead, it will take the assistance of private landowners and federal partners. With respect to the trapping and releasing of ruffed grouse Marcus indicated that this topic was also discussed during the summit and the recommendations in this area are contained in the report of those summit meetings.

Linnea Petercheff added that it is her belief that the Division of Fish & Wildlife biologists believe that this rule is another action that will coordinate with the activities of the Division of Forestry and is a step in the right direction.

Bandos also noted that the reduction of hunting opportunities results in less reason to buy Indiana's Game Bird Habitat Stamp, the money from which is used by DNR to purchase land. Bandos pondered that by limiting ruffed grouse hunting opportunities as proposed in this rule "we shoot ourselves in the foot."

Mitch Marcus replied that grouse hunting opportunities are already limited by the species' population. Stating that he could not actually quantify it, Marcus speculated that population decreases had probably already already caused a greater decrease in stamp sales than would the proposed rule.

Pete Hanebutt, Columbus, Indiana
Hanebutt provided written materials as part of his comment that have been attached as Exhibit A1. He stated that he is a grouse hunter who belongs to both the Ruffed Grouse Society and the Loyal Order of Dedicated Grouse Hunters and he believes "this is the stupidest thing that's come down the pike." Hanebutt explained that he was part of the grouse summit that took place in 2008 after hunters complained about a previous Department proposal to limit the season. Hanebutt explained that the summit resulted in a report that contained many recommendations for action and "to my knowledge not a

single part of that report has been acted on. And yet DNR… is coming back with the same thing as they proposed a few years ago."

Hanebutt noted the common knowledge that the problem faced by ruffed grouse relates to habitat. He cited research that concludes that hunting results in only compensatory mortality and is not additive. He concluded that it is not hunting that has harmed the ruffed grouse populations. Instead, Hanebutt claimed that the DNR has "dropped the ball on this." He noted the lack of interaction between Department Divisions and the lack of cohesive actions on the part of the DNR's divisions as contributing to the problems faced by the ruffed grouse species.

Hanebutt stated the Department has a responsibility to manage the forest property and they have failed to do that. He continued that it is disingenuous for the DNR to limit hunting on state ground when the money from stamps that is supposed to be used for habitat restoration has not been used for the enhancement of habitat for grouse, quail or pheasant but instead has been used for land purchase. Hanebutt stated that this proposal is "short-sighted and I think it's just a way for them (DNR) to obfuscate their mismanagement."

Jeff Bush, Columbus, Indiana
Bush stated that he is a grouse hunter who until last year hasn't bought a grouse stamp in Indiana for five (5) years. He goes to Michigan, Kansas, Iowa and South Dakota like many other Indiana hunters, which results in lost license sales fees. Bush added that "right now the State of Indiana does nothing for any bird hunter. There's a little bit of effort with regard to pheasant." Bush noted that the waterfowl project at Goose Pond has nearly eliminated quail hunting there that hasn't been replaced. Further, Bush noted that the Department has lost ground at Atterbury and replaced it with two-thirds the amount of land near Greencastle but emphasized his belief that DNR is not taking much action for bird hunters.

Jack Corpuz, Indianapolis, Indiana
Corpuz read the position of the National Ruffed Grouse Society as follows:

> "Given the dramatic decline in grouse numbers of several decades and the relative lack of forested public lands, this change makes sense even though we never like seeing hunters lose opportunity. We would like to see the State evaluate where they are in 5 years following the change, if it's made."

Corpuz continued, stating that the Indiana Chapter of the Ruffed Grouse Society also supports the proposed change but would also like to see a five year sunset provision for re-evaluation of the rule.

Corpuz noted that Indiana has one of the best trapping programs for grouse in the country but he understands the desire of the DNR to wait to conduct any trap and release

programs until the state forest that has already been cut can mature into appropriate habitat for the birds that are relocated.

Corpuz also noted that at the present time there is no market for timber and as a result only so much timber can be cut at one time. Corpuz stated that he favors the Department's proposal at this time.

Doug Allman, Hamilton County, Indiana
Allman agreed with the comments of Pete Hanebutt, noting that he is not in favor of the rule proposal. Allman stated that there has not been enough effort on the part of the agencies noting that the Fish and Wildlife Service should be involved and there needs to be more pressure on the Hoosier National Forest from the State. Allman observed that that the State needs to have a plan in place. DNR had the summit and developed ideas but "nothing was done."

"This has been coming down the road for a long time." For twenty years nothing has been done and "now we're penalizing hunters. I'm to the point with the State and others that if you want to drive it (ruffed grouse) to extinction…drive it to extinction. Nothing is being done, hunters are being penalized and we could see this coming."

Allman noted that Steve (Backs) is being honored presently for "being the greatest turkey biologist in the world and it's ironic that he gets the credit for how great our turkey's are…. And yet, grouse, here we are, we're teetering on the brink of extinction." Allman expressed his belief that it's all politics and that hunters should not be blamed for the plight of ruffed grouse.

Allman noted that "the feds don't want to pay attention to it" and the United States Forest Service "doesn't wasn't to give it consideration" and the State "doesn't want to give it specific consideration" noting that maybe the bird should be allowed to go extinct. Allman expressed his opinion that government agencies have not taken action to consider the species saying that "if it takes it (ruffed grouse) going by the wayside" the agencies might then consider the species and deal with it.

Allman requested that when this rule proposal returns to the Natural Resources Commission for consideration that the DNR identify the number of grouse hunters, harvest numbers for grouse in Indiana and how this proposed change is expected to impact those harvest numbers. Mitch Marcus explained that these numbers were captured in the latest small game harvest survey results that are online. Linnea Petercheff stated that the DNR would include these numbers in their response to the public comments.

Allman also sought confirmation that under the proposed amendment relating to turkey hunting that turkey hunters would only be required to wear hunter orange during that portion of the turkey season that overlapped with the deer muzzleloader season and did not have to be worn by turkey hunters during the late deer archery season. Allman's understanding was confirmed by the hearing officer.

Bill Herring, Morgan County, Indiana
Herring observed that Indiana's grouse population is very low and asked whether the low population in Indiana corresponds with grouse population cycles overall. Pete Hanebutt and Karl Kovach, other members of the public who participated in the public hearing, responded by confirming that there is a ten year cycle associated with grouse populations. According to Kovach, at the present time most other nearby states have populations that are on the upswing if not at their peak while Indiana's grouse population is at an all time low. Hanebutt agreed, indicating that recent drumming surveys in Wisconsin indicate that populations there are on the upswing.

Mitch Marcus of the Department stated that historic population numbers for ruffed grouse were included with the information provided to the Advisory Council and it will likely be included in the DNR's response to the public comments received since that time.

With respect to the proposed amendment to the turkey rules, Herring offered his support for the extension of the firearms season. He noted his belief that the season could be extended further in some counties and that the bag limit on "toms" could be increased to two in some counties, without effecting the populations

Karl Kovach, Indianapolis, Indiana
Kovach stated that he is a member of the Indiana Grouse Society and as a member he supports the proposed change to the grouse rules although he personally somewhat disagrees with the action being taken by the Department. Kovach stated that he does not hunt in Indiana because he owns property in Michigan. He characterized bird hunting in Indiana as a good day off work walking in the woods.

Kovach echoed earlier comments requesting that the rule revert to its existing language in five years or be reevaluated. He expressed his hope that Jack Seifert's (DNR Division of Forestry) cuttings will have a positive impact on the populations of ruffed grouse and other species that will benefit from that type of habitat.

Keith Dutton, Monroe County, Indiana
Dutton stated that he has been a grouse hunter all of this life noting that he hasn't had a shell in his gun for 5 – 6 years. He stated that he missed the hunting and sadly reported that his 19 year old son who is presently serving in the military has never had the opportunity to hunt grouse in Indiana. Dutton agrees with many of the other comments noting that the real issue is habitat. He expressed his belief that the hunters need to get together to apply pressure to address this problem. "There's going to have to be more effort among the people that are true environmentalists who are truly concerned about …not just the grouse … but all species to get them involved. Until that happens, I don't think you're going to see anything."

Dutton explained that he is in favor of this proposal because he doesn't see any alternative. He expressed his pleasure that there are trees being cut and offered to assist in that effort. He also stated his belief that trapping and release will have to happen in the

future. Dutton noted that maybe a hunting moratorium will make the people mad enough to cause them to get involved.

Don Gorney, Indianapolis, Indiana
Gorney commented as the President of the Amos W. Butler Audubon Society in favor of the Department's proposal on ruffed grouse. He noted that everyone wants more grouse. Gorney noted that Indiana has one of the southern-most populations of grouse and this population is different than grouse in Minnesota and Wisconsin making a comparison of the populations difficult. Therefore, Gorney expressed concern with the comparison of Indiana's populations to those of Appalachia, Delaware, Maryland and Virginia.

Gorney noted that the measures being taken presently to improve habitat are going to take time to have an impact and result in improvement in the grouse populations. He noted further that there is no easy answer and that coordination and collaboration between governmental agencies and private entities is necessary.

Gorney expressed agreement with many of the comments. However, Gorney responded to an earlier comment regarding the loss of quail hunting opportunities at goose pond noting that goose pond has one of the best quail populations in the State.

Carl Duke, Avon, Indiana
Duke stated his support for the Department's proposals to increase turkey hunting opportunities, stating that it was "past due". He stated that he's never seen so many turkey saying, "something the DNR, or somebody, is doing is right." Dukes observed that turkey management seems to be going "exceedingly well." Duke expressed his thought that a bonus program, similar to that used to reduce deer populations in certain counties, could also be used for turkeys in counties where populations are highest.

"Exhibit A1"

Written Material Submitted at the Public Hearing by Pete Hanebutt

Memorandum

June 23, 2010

To: IN DNR, Natural Resources Commission

Fr: Pete Hanebutt, Conservationist and Grouse Hunter
706 Noble St. Indianapolis, IN 46203

Re: Proposed changes to Indiana's Ruffed Grouse Season

I have been a grouse hunter in Indiana for over thirty years, am a member of the Ruffed Grouse Society, the Loyal Order of Dedicated Grouse Hunters and have been an engaged advocate for the DNR and grouse habitat in both my personal life and in my professional career. Over the past 25 years, I have volunteered my time to help raise public awareness of the habitat needs of ruffed grouse in addition to testifying before legislative committees and in other public venues regarding the needs of early secession species.

Having said this, I think that the IN DNR proposal to reduce the ruffed grouse season on state property is one of the most ill-conceived and disingenuous frauds ever hoisted upon the general public and hunters of Indiana.

A few years ago the DNR had a similar season limiting proposal, and after grouse hunters questioned their reasoning on the proposal, the DNR set up a Grouse Summit to discuss the issue. The outcome of *this* meeting was that the DNR set up a series of Grouse Summit Meetings to review the grouse situation within the state. I was very happy to participate as one of 8 individuals selected the serve on this study committee throughout the summer of 2008. The committee met several times and a report was compiled at the end of the process – Unfortunately that was the end of the discussion.

Commission Members will recall that I referenced the Summery Report of the Grouse Summit Meetings when I testified at their meeting #3 earlier this year. To my dismay, when I mentioned the Summit Report it was discovered that the DNR had not even shared the final report with the Commission. The final Summit Report included 6 Action Steps and each action step contained several bullet points, further defining ideas that the committee concurred upon. There is no statement or reference in the report to limiting grouse seasons or hunting opportunities as a way of helping the plight of Indiana's ruffed grouse population. More to the point: To my knowledge NONE of those 6 Action Steps have been acted upon to date.

I have included the Summery Report of Grouse Summit meetings for your review.

There is very little debate from the scientific community, hunters, conservationists or the general public regarding what ails the grouse population in Indiana – Habitat remains the only major limiting factor for grouse populations. Ruffed Grouse require early secessional habitat for safety, feeding and nesting. Unfortunately in Indiana (as well as some other states) it has become politically unpopular to manage and harvest timber on state and federal lands. States in the traditional ruffed grouse range that have managed to maintain a balance of both old growth and secession habitat have been able to retain their grouse populations – Our neighbors in Ohio and Kentucky are good examples.

I have attached several reports from various state game departments and regional studies that attest to the fact that it is habitat rather than predation or hunting that is the limiting factor for healthy grouse populations. *In Indiana, our DNR staff seems to want to imply that by limiting hunting days afield, they will somehow address the decline in our grouse population* without having to focus on the potentially hot political topic of actually managing the state forests. By taking a leadership role in state forest management, our DNR could actually provide a habitat benefit for multiple forest species and provide a revenue source for both local counties and the state; while still preserving plenty of mature forests for those species that require those habitats. With this proposal to limit our hunting season, all that the DNR is accomplishing is to punish the one group of stakeholders, grouse hunters, who have actually committed to grouse habitat through our hunting license and stamp fees.

For about thirty years now Indiana has had a Game Bird Habitat Restoration Stamp - This is a dedicated fund and Indiana Code 14-22-8-6 states in part:

> The department shall administer the fund. The director may expend the money in the fund exclusively for the purpose of restoring the habitat of the various game birds in Indiana.

Indiana Code 14-22-8-7 which was added at some later date states:

> Sec. 7. (a) The department shall contract for the development of game bird habitats in Indiana. Each contract must: (1) be for at least three (3) years; and (2) provide a plan for the development of habitat for at least one (1) species of game bird. (b) The department may seek the cooperation of federal agencies such as the Agricultural Stabilization and Conservation Service or the Natural Resources Conservation Service in the development of habitat plans and compensation for habitat plans. Monetary compensation may not exceed one hundred dollars ($100) per acre per year and each contract may provide that the site be open for regulated public game bird hunting. *(c) The department may purchase land in Indiana from willing sellers for the development of game bird habitats.*

What this has translated into in practical application is that the DNR has used the habitat stamp monies as a slush fund for land acquisition, rather than dedicating the fund to specific habitat improvement for our native species.

I understand that the DNR cannot segregate the funds generated through stamps into proportional accounts for each species – However, the fact that none of the money generated has been used specifically for grouse in recent memory indicates to me that the department is not in any way fulfilling their obligation of stewardship. Using these funds to purchase additional state properties with the promise that the new purchase area "could become grouse habitat", is just a little too thin for me to believe.

Even more disappointing is the fact that the DNR has had wonderful opportunities to improve habitat for grouse and other species following natural occurrences such as forest fires and tornadoes, and yet they have consistently ignored these opportunities. In some of these cases, tapping into habitat stamp monies would not have even been necessary as these salvage jobs would pay for themselves - It's just a matter of lack of initiative on the part of DNR staff.

Before the state enacts any changes to the grouse season I would like to have the DNR justify the management practices (or lack there of) that have lead to the current state of affairs. There has been no active habitat enhancement and species management, and I doubt that the DNR has any cross-division plan to address the problem. At this point, only the Division of Forestry has made any effort to enhance habitat for grouse, but they done so without much cooperation from Parks, Reservoirs or Fish & Wildlife.

Can the DNR tell us how many grouse hunters are in the state? As stated, I've been hunting grouse in Indiana for 30 years and have never been surveyed regarding my hunting habits or annual grouse harvest. If the DNR doesn't know scientifically how many grouse hunters there are in the state, or what current harvest levels are, how can this proposed action of limiting the season have a measureable impact? We haven't had a science based drumming survey in a number of years – How will we measure if this proposed action has any impact. Even is the proposal has a sunset clause, there's no base line established to gauge success or failure.

If the goal in this proposal is to help a declining grouse population – Where's the DNR's plan to help increase habitat for the species. It seems that the DNR is only asking to cut any potential funding that may benefit the species. If the season is further reduced as proposed, there will be less incentive to hunt grouse; and if hunters stop pursuing grouse any potential habitat stamp money will dry up. This entire proposal just seems to be the product of backwards thinking!

Our neighboring states of Kentucky and Ohio have decent, not great, but decent grouse populations and they have not reduced their grouse season – In fact their seasons run well into January or February. Their state budgets, staff issues, timber industry and climate are not too different than ours. The only major difference is management – Our state has failed in management of this species and all others that rely on early secession habitat. And now their only solution to the problem is no solution at all; it does nothing to help the species find better habitat, or grow more habitat for future generations.

The Indiana DNR's solution to the grouse population problem is nothing but a politically expedient hand wringing that allows the staff to ignore habitat as the true issue, and falsely blames hunters for the state's lack of wildlife management.

The Conservation of Ruffed Grouse in Indiana

Summary Report of Grouse Summit Meetings – 2008

Indianapolis, October 1, 2008

The first of four "Grouse Summit" meetings concerning the plight of ruffed grouse in Indiana was held May 30, 2008. The initial meeting brought together representatives of the conservation & hunting community specifically interested in ruffed grouse along with representatives from natural resource agencies to discuss mutual concerns about the severe 25 year decline in ruffed grouse populations due to advancing forest succession. Currently, ruffed grouse population levels are estimated to be < 4% of what they were 25 years ago and may be extirpated from portions of the known 1983 distribution in Indiana.

Ongoing and proposed actions to increase habitat and ruffed grouse populations were discussed. Given the complexities of those proposals and actions, the group decided a smaller subcommittee composed of selected sportsmen, natural resource specialists and natural resources agency administrators should meet to "flesh out" the details of the proposals and agree upon actions to improve populations of ruffed grouse. The findings of the "grouse summit" meetings were to be presented as a summary report to the original group and other interested parties. The subcommittee met 3 times over the summer to reach some type of consensus to best accomplish the needed actions. Attendees at 1 or more of the meetings included:

Mr. Pete Hanebutt, Grouse Hunter, RGS member.
Mr. Jack Corpuz, Grouse Hunter, FWCC representative, RGS member.
Mr. Wayne Bivans, Chief of Wildlife, DFW, IDNR
Mr. Mitch Marcus, Staff Specialist/Research Supervisor, DFW, IDNR
Mr. Phil Bloom, Director of Communications, IDNR
Ms. Judi Perez, Acting District Ranger, HNF, USFS
Mr. Scott Haulton, Forest Wildlife Biologist, Division of Forestry (DoF), IDNR
Mr. Steve Backs, Ruffed Grouse Biologist, DFW, IDNR

Primary Expectations of Summit Meetings

1) Maximize habitat enhancement programs and opportunities to improve ruffed grouse populations.
2) Develop a public appreciation and desire for early succession forests.

Challenges Identified during Subcommittee Meetings

Suitable habitat for ruffed grouse exists primarily in hardwood stands ≤ 20 years with 30% of the forest in early succession or young forest types stands across a landscape on a scale of townships to sustain a viable grouse population. Ideally, the suitable habitat areas should be in close proximity (¼ to ½ mi) to better assure successful grouse dispersal and colonization. Cuttings 15-20 acres are the most cost effective from a silvicultural standpoint and for ruffed grouse on larger and public ownerships in Indiana, especially where oak regeneration is an important objective. Where habitat for ruffed grouse is the primary management objective, preferred grouse habitat would be created by an equivalent acreage of smaller 5-10 acre cuts. The smaller cuts would also be more applicable to generally smaller, private ownerships.

Sufficient suitable early successional and young forest habitats do not exist (1 or < 2% current estimate) to sustain ruffed grouse populations over the next decade at the current rate of decline, nor is suitable grouse habitat being created either naturally or man-induced at a rate to overcome the negative impacts of advancing forest succession on ruffed grouse populations. While the DoF has recently stepped up its timber harvesting with a goal of creating 10% in early successional habitat, current harvests rates only amount to half of its annual growth. Early successional and young forest habitats could be targeted with new acquisitions. HNF timber harvests have been stymied by never-ending appeals with no commercial hardwood timber sales in almost 25 years although there is apparently a renewed attempt to increase commercial hardwood harvests in a very limited area, albeit in a less physiographically favorable are of south-central Indiana. DFW has not managed its timber resources because of PR Federal Aid issues. Timber harvesting on private lands is not consistent due to ownership patterns (size and temporal) and is generally not intense enough to create sufficient hardwood regeneration for ruffed grouse.

Restoration of ruffed grouse through trap/transplant, even if suitable and adequate grouse populations existed, would be extremely costly and a fruitless effort doomed for failure if adequate habitat is not created first and a long term solution to advancing forest succession is not addressed. Recently cut-over or extensively disturbed areas (e.g., tornado) take at least 5 years post disturbance to come into grouse habitat and will only remain suitable grouse habitat 10-15 years thereafter depending on the site conditions. Under current administrative logistics, it takes 2-3 years of sale preparation on State lands to put a saw to wood; longer on Federal lands. While the majority of forest land is in private ownerships, the smaller ownership parcels often have quite varying ownership objectives that present another array of problems to create adequate amounts of young forest habitats even in the short term. Even under the best situations, there are limitations in the current timber markets to absorb a sudden surge of wood fiber from all sources. *Public acceptance of timber harvests however, is by far, the most overriding issue limiting opportunities to create and maintain young forest habitat.*

The public's lack of understanding that periodic disturbance plays a role in maintaining ecosystem diversity and integrity is a formidable obstacle to using man-induced tools to mimic natural disturbance events in a prescribed manner. The lack of young forest habitats is not just a problem for ruffed grouse but a consortium of animal and plant species not only in Indiana but across much of the eastern US. The public does not understand the resilient capabilities of renewable resources and that the central hardwoods region is one of the most resilient in North America. Declining ruffed grouse populations are just symptomatic of declining ecosystem diversity and the solution has to be addressed as an ecosystem management issue beyond individual species' needs. Disturbance is an integral part of ecosystem dynamics and natural disturbances no longer function to the degree they did historically in a landscape unaltered by humans.

Perhaps the most revolving theme of the summit meeting discussions was communication and education to develop a public appreciation of early succession and young forest types as part of maintaining ecological diversity. Public acceptance of man-induced disturbances is critical to allowing professional natural resource managers to use proven management tools, whether it be prescribed burning, timber harvesting, soil disturbance, or herbicide use. The demonstrated successful use of silvicultural techniques on public lands to create a diversity of habitat types and associated wildlife responses is also imperative if private forest owners are to even consider such habitat values and management practices in their land ownership objectives.

The "early succession and young forest" messages should be an integral part of every natural resource agencies' communications and outdoor education programs along with the efforts of <u>all</u> agencies

administrative, communications, and field staff. The early succession and young forest "ecological awareness" needs to transcend agency directors and Governor's administrations. More importantly, the message needs to come from what is perceived as non-vested, indirectly associated entities (e.g., academic and scientific communities, Audubon, Isaak Walton Leagues, Wildlife Federation, birding and nature appreciation groups). The public's improved acceptance of prescribed fire in recent decades is an example of what needs to be accomplished with creating and maintaining young forest habitats.

Actions Needed to Overcome Challenges

1.) Initiate a Department-wide communication and education effort through existing programs and conservation groups to improve the appreciation and acceptance ("ecological awareness") of creating and maintaining early succession and young forest habitats for a wide range of wildlife species. Periodic disturbance is a needed infusing restoring element of ecosystem dynamics.
   - Primary target audiences include agency staff, conservation groups, education community, legislative members, consulting foresters, woodland owner groups, timber groups, professional scientific organizations, SWCD's, NRCS district conservationists, cooperative extension services, and the public-a-large.
   - IDNR Outdoor education, interpretive naturalist, and private land (wildlife and forestry) programs would be key information disseminators.
   - Conservation groups (e.g., RGS, NWTF, IWF, etc) are integral partners not only in disseminating information but to provide supplemental support for young forest communication and education efforts (e.g., COVERTS, forest stewardship programs).
   - Promote the conservation and wise use of renewable forest resources over dependence on nonrenewable fossil resources.
   - Integrate provisions and recommendations of NA Conservation Plans as best possible for ruffed grouse, American woodcock and Landbird Habitat Conservation Strategy.

2) Create a ruffed grouse "core population area" where land management will include a focused effort to increase and maintain the endemic Appalachian subspecies (*Bonasa umbellus monticola*) for a possible source population should trap/transplant efforts be warranted; if unoccupied areas of suitable grouse habitat and sufficient size are identified in the future.
   - Determine the current distribution status of ruffed grouse.
   - Monroe, Morgan Brown, Jackson, Lawrence, Martin, and Orange counties provide the best opportunities in terms of existing populations, contiguous forest cover, and favorable micro-climate conditions.
   - Public forest lands include: Morgan- Monroe SF, Yellowwood SF, Jackson-Washington SF, Martin SF, Monroe Reservoir, and Brown County State Park.
   - Place emphasis on silvicultural techniques that create dense stands of hardwood regeneration that enhance grouse brood habitat.
   - Parameters and techniques for ruffed grouse restoration already exist. Suitable habitat of sufficient size and grouse populations of capable of sustaining trapping activity do not exist.
   - Reduce potential negative impacts to ruffed grouse breeding stock on public lands.

3) Expand or refine existing monitoring surveys of grouse populations to better assess response to habitat improvements and whether management efforts are adequate to improve grouse populations.

- Continue or increase existing range-wide spring roadside drumming surveys and drumming activity center counts.
- Develop or re-implement "walking" surveys or drumming activity center counts in specific management areas to determine the relative degree of grouse population response.
- Potentially utilize volunteer observers to increase coverage on specific areas.
- Utilize information from other avian or wildlife monitoring surveys.

4) Develop and maintain young forest habitats across all public forest lands to assure needed ecological and habitat diversity for all wildlife species.
   - Create example demonstration areas of young forest habitats using vegetative disturbance techniques on all state properties where sufficient forest cover exists.
   - Focus effort on state properties in potential grouse range but young forest habitats should exist on all state properties.
   - Beyond possible timber harvest revenues, use of wood fiber should be used to demonstrate that it is a renewable natural resource.
   - Develop creative ways to show other benefits of creating early succession and young forest habitats (e.g., wood products for buildings/structures, firewood for fuel and to reduce spread of EAB, reduced property operating expenses, improved vistas).
   - Determine ways to remove or overcome administrative and Federal Aid barriers to timber harvesting/management on DFW lands.
   - Provide informative signage or kiosks near demonstration areas to inform and help educate the user groups and the public.

5) Encourage timber harvests on private lands.
   - Provide technical information and assistance.
   - Remove barriers, zoning restrictions, and limitations to timber harvests on private lands.
   - Develop or provide incentives for landowner cooperatives to facilitate timber harvesting across individual ownerships.
   - Pursue "use value assessment" type incentives for actively implementing timber management on classified forest lands.
   - Place emphasis on using silvicultural techniques that create dense regeneration.
   - Pursue efforts to develop better markets for low grade timber products.

6) The Game Bird Habitat Restoration Stamp Fund (GB) continues to be a point of discussion. There is the feeling that some of the funds need to be spent on the grouse program.
   - Instead of using game bird habitat funds for primarily land acquisition, funds should be used funding grouse studies/monitoring or other needs for grouse program. Some feel that Gamebird legislation needs to be changed to allow other uses.
   - Find ways to incorporate GB funds to enhance timber harvests that would improve positive impact on grouse populations on state lands.
   - Currently the legislation (IC 14-22-8-7) infers that the funds be used to compensate for habitat plan development for programs made available through various federal agencies. The legislation further states that the funds may be used to purchase land.

Ruffed Grouse Population Ecology in the Appalachian Region

PATRICK K. DEVERS,[1,2] *Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061, USA*
DEAN F. STAUFFER, *Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061, USA*
GARY W. NORMAN, *Virginia Department of Game and Inland Fisheries, P.O. Box 996, Verona, VA 24482, USA*
DAVE E. STEFFEN, *Virginia Department of Game and Inland Fisheries, 6701 Parkway Drive, Roanoke, VA 24018, USA*
DARROCH M. WHITAKER, *Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061, USA*
JEFFREY D. SOLE, *The Nature Conservancy, 642 W. Main Street, Lexington, KY 40508, USA*
TOM J. ALLEN, *West Virginia Department of Natural Resources, P.O. Box 67, Elkins, WV 26241, USA*
STEVE L. BITTNER, *Maryland Wildlife and Heritage Service, 14038 Blair's Valley Road, Clear Spring, MD 21722, USA*
DAVID A. BUEHLER, *Forestry, Wildlife, and Fisheries, University of Tennessee, Knoxville, TN 37901, USA*
JOHN W. EDWARDS, *Wildlife and Fisheries Resources Program, West Virginia University, P.O. Box 6125, Morgantown, WV 26506, USA*
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HARRY A. SPIKER, Jr., *Maryland Wildlife and Heritage Service, 1728 Kings Run Road, Oakland, MD 21550, USA*
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BRIAN C. TEFFT, *Rhode Island Division of Fish and Wildlife, P.O. Box 218, West Kingston, RI 02892, USA*

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[1] *E-mail: patrick_devers@fws.gov*
[2] *Present address: United States Fish and Wildlife Service, 11410 American Holly Drive, Laurel, MD 20708, USA*

DNR
MICHIGAN DEPARTMENT OF NATURAL RESOURCES
WILDLIFE DIVISION

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SEPTEMBER 13, 1996

REVIEW OF THE 1995 GROUSE AND WOODCOCK SEASON WITH PROSPECTS FOR 1996

by
John W. Urbain and Joseph D. Robison

1995 Season in Review

The mail survey of small game hunters is not available at this time so no hunting statistics for 1994 or 1995 is available.

Michigan had 176 Cooperators that filled out special hunter report cards for the 1995 season to gather additional information about ruffed grouse and woodcock hunting. Cooperator hunters spent an average of 33 hours hunting last fall which was two hours less than in 1994. Our average grouse hunter spends about 18 hours afield during there fall hunting days. Flushes per hour of hunting for ruffed grouse increased 20 percent to 1.48 birds per hour in 1995 statewide. Up 60 percent in Zone I (Upper Peninsula) and in Zone II (Northern Lower Peninsula) it was up 16 percent respectively. For woodcock, the flush rate statewide was up 12 percent (1.45 birds per hour) - down 4 percent in Zone 1 but up 23 percent in Zone II respectively.

Ruffed grouse - 1996 season forecast

Ruffed grouse numbers are expected to remain at a low level this season but continuing to improve. The spring drumming survey in Zone 2 showed a 23 percent decrease. Part of this decrease can be explained by the timing of the spring surveys. Surveys were not run in the other two Zones because of travel restrictions. Fortunately, over winter survival should have been better than normal for grouse since last winter had snow from early November through April. Snow roosting conditions in the U. P. should have helped survival to spring breeding. Lower peninsula areas had crusting conditions that prevented snow roosting most of the winter. The nesting season was late to arrive and remained cold. Nesting was delayed by two weeks. Wild turkey hunters and fisherman reported hearing "many more" drumming males this spring than in past years. Reproduction should add substantially to the fall population. Upper peninsula field biologist are reporting improved numbers of grouse. Lower peninsula field biologist are reporting similar numbers to last year. Hunting for grouse will be approaching the "good" category.

Counts of woodcock singing in 1996 were down 5 percent from 3.71 to 3.53 peents per route (about 25 percent below normal). Woodcock banders reported the nesting season about 10 days later than normal. Banders reported many flying adult birds during searches and birds harder to find. We expect the nesting season results to show that nesting was below normal. Locally-raised and migrating woodcock numbers are both expected to be similar to last years low level.

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specifically from goshawks, and stated that as effective as goshawks are as grouse predators, the effect of their predation can be lessened if grouse have proper cover. Gullion also stated that the best cover is a canopy of deciduous trees, which allows grouse to see raptors before they themselves are seen. The Michigan ruffed grouse HSI score is based on the food and cover requirements of ruffed grouse. The low values (< 0.50) for overall HSI scores for the HNF and PRCSF open and closed sites indicate that the amount of quality cover for grouse on each site is not at a maximum. While it is understood that both the HNF and PRCSF areas are by no means managed exclusively for ruffed grouse, improvement of habitat for grouse on each area would benefit grouse populations.

Though this information is preliminary, hunting appears to have had no direct and probably limited indirect effect on the HNF and PRCSF grouse populations. Thanks are due to **Allison Gormley** and **Meg Clark** for their hard work in gathering this information.

The study is expected to continue for two more years. For more information contact:

WILDLIFE DIVISION
PO BOX 30028
LANSING MI 48909

Woodcock regulatory change

The U. S. Fish and Wildlife Service in July, proposed that Michigan and other Flyway states open the woodcock season on October 1 and reduce the daily bag limit to three. This is based on their concern over the long-term declines in woodcock trends. Breeding indicies have declined 36% in the Central Region over the last 28 years.

The Department of Natural Resources would support these changes if hunting was identified as the cause of the woodcock decline. If hunters are required to reduce opportunities, there must be a positive benefit to woodcock from this loss of recreation. Michigan forests are getting older and currently are providing less habitat for woodcock.

The Department of Natural Resources will support the implementation of a national woodcock hunter survey network, intensive mortality studies and habitat (quantity and quality) studies.

Final authority for regulating the hunting of woodcock is the responsibility of the U. S. Fish and Wildlife Service. A change in the season for hunting woodcock in Michigan may cause a season change for hunting ruffed grouse.

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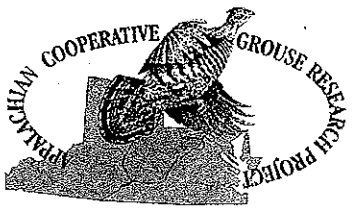

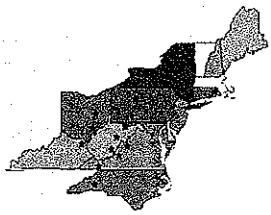

Appalachian Cooperative Grouse Research Project:
Maryland Study Site Summary

by
Steve Bittner, Harry Spiker and Bob Long
Maryland Department of Natural Resources
Wildlife & Heritage Service

Background

Wildlife biologists in the mid and southern Appalachians have expressed concern over declining ruffed grouse *(Bonasa umbellus)* populations throughout the region. Some have postulated that the decline is a result of changing habitats, while others have suggested that late season hunting may be impacting grouse populations. In order to determine what was causing grouse declines, several state wildlife agencies agreed to jointly study this species. In 1996, Maryland joined the states of Ohio, Kentucky, Virginia and West Virginia in forming the Appalachian Cooperative Grouse Research Project (ACGRP). Soon after that, Pennsylvania, North Carolina and Rhode Island joined the study.

Factors limiting grouse populations outside aspen dominated habitats are poorly understood. Forest succession and habitat losses may be primary factors influencing ruffed grouse populations. Forest inventory data indicate early successional habitats are declining in the Appalachian region. Fragmentation of suitable grouse habitats may be occurring as timber harvesting declines and forests mature.

While the decline in the quality or quantity of early successional habitats is presumed to be a significant factor contributing to the apparent decline in grouse numbers, other causes have been suggested. These include various sources of mortality, both non-hunting and hunting related. Early research in northern climates suggested that grouse were an underutilized game species and could tolerate high harvest rates. Many states thus established long (Oct.-Feb.) grouse hunting seasons. However, recent research in northern latitudes suggests that grouse hunting mortality may be somewhat additive to natural mortality, and has greater population consequences late in the season (Dec.-Feb.) than early in the season during juvenile dispersal.

This research project was designed in 2 phases. Phase 1 investigated grouse population dynamics in 9 study areas located in 5 states. The first phase investigated basic population parameters and established possible hunting influences. Research into reproduction, survival and habitat relationships were also conducted during the first phase.

The second phase of the study looked into the effects of various hunting season structures. Hunting seasons were closed on selected study sites in an effort to determine if

survival rates differ. Additional research in Phase 2 examined hen condition prior to nesting and chick survival for the 2 months following hatching.

The objectives of the ACGRP were to:

1. Estimate survival rates and identify limiting factors for ruffed grouse populations.
2. Estimate reproductive rates and identify limiting factors to reproduction.
3. Determine if harvest is compensatory or additive.
4. Evaluate habitat selection and quality.

Methods

Ruffed grouse were trapped in late summer and fall months utilizing lily pad traps. Traps were placed in suitable grouse habitat on Mt. Nebo WMA and Garrett State Forest in Garrett County and checked once per day. Once removed from the trap, grouse were fitted with a necklace-style radio transmitter. Weight, sex, age and general condition of trapped birds were noted. Each grouse was also fitted with a reward leg band. Grouse were then released at the trap site within 20 minutes after removal from the trap. Study objectives were to place radios on 40 grouse during each fall trapping season.

All grouse were monitored twice per week throughout the year using radio telemetry equipment. All locations of birds were estimated by taking at least 3 compass bearings from known tracking locations. Bearings were mapped to determine approximate bird locations.

All radio transmitters were equipped with motion sensitive switches. These switches activated when the radio had not moved for 8 hours. It was assumed that a grouse was dead if the activity switch was activated. Researchers then located the radio collar and determined the cause of death for each grouse.

Each transmittered hen was closely monitored during the nesting season. Incubation dates, clutch sizes and hatching dates were determined from telemetry locations and nest checks. Chick survival was monitored by checking broods at 1, 3 and 5 weeks of age.

Habitat data was collected at all nest and brood sites. This data was compared to overall habitat availability to determine preferred brood habitat. Determining the relationship between habitat and grouse survival was a key objective of this research project.

Results

Trapping Success

Trapping success varied over the 6-year period. Grouse were trapped during the Fall of 1996, 1999 and 2000, and during the Spring and Fall of 1997, 1998 and 2001. A total of 228 grouse were trapped in Maryland during the 6-year study, with 118 females and 110 males captured (1.07/1.00 female/male ratio) (Table 1).

Table 1. Ruffed grouse survival rates by age class in Maryland, 1996 – 2002

	1996	1997	1998	1999	2000	2001	TOTAL
Total Grouse Trapped	24	30	49	38	39	48	228
Total Grouse Radioed with Known Fate	22	27	39	33	36	33	190
Total Juveniles Captured	16	14	24	27	27	22	130

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Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061, USA
Virginia Department of Game and Inland Fisheries, P.O. Box 996, Verona, VA 24482, USA
Virginia Department of Game and Inland Fisheries, 6701 Parkway Drive, Roanoke, VA 24018, USA
The Nature Conservancy, 642 W. Main Street, Lexington, KY 40508, USA
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Ohio Department of Natural Resources, 9650 State Route 356, New Marshfield, OH 45766, USA
Rhode Island Division of Fish and Wildlife, P.O. Box 218, West Kingston, RI 02892, USA

The Appalachian Cooperative Grouse Research Project (ACGRP) was a multistate cooperative effort initiated in 1996 to investigate the apparent decline of ruffed grouse (*Bonasa umbellus*) and improve management throughout the central and southern Appalachian region (i.e., parts of Ohio, Pennsylvania, Rhode Island, Kentucky, West Virginia, Virginia, and North Carolina, USA). Researchers have offered several hypotheses to explain the low abundance of ruffed grouse in the region, including low availability of early-successional forests due to changes in land use, additive harvest mortality, low productivity and recruitment, and nutritional stress. As part of the ACGRP, we investigated ruffed grouse population ecology. Our objectives were to estimate reproductive rates, estimate survival and cause-specific mortality rates, examine if ruffed grouse harvest in the Appalachian region is compensatory, and estimate ruffed grouse finite population growth. We trapped >3,000 ruffed grouse in autumn (Sep–Nov) and spring (Feb–Mar) from 1996 to September 2002 on 12 study areas. We determined the age and gender of each bird and fitted them with necklace-style radiotransmitters and released them at the trap site. We tracked ruffed grouse ≥2 times per

Ruffed Grouse Research Project

West Virginia is involved in the Appalachian Cooperative Grouse Research Project. This multi-agency, multi-state research effort is investigating the population dynamics and habitat use of ruffed grouse in the central Appalachian region. There are 15 study areas distributed throughout the eight states with 2 in West Virginia. One is located in Randolph County at Adolph, and the other in Greenbrier County just north of White Sulphur Springs.

Objectives of this study are to radio-equip and maintain 40 birds on each area, and to monitor these birds twice each week. Data was collected on mortality, when it occurs and the causes, the types of habitats selected by grouse in each season, the nest and brood production as well as chick survival, and the impacts of hunting on grouse populations. Across the 10 study areas 1,200 grouse have been radioed and monitored.

To date grouse mortality has been attributed to mainly avian predation with mammal predation in second place. Hunting has been a small part of the predation picture averaging about 15% of the total. However, production has also been low in this region with only about 1 chick per adult reaching maturity. This low production tends to hold grouse populations at low levels, resulting in a greater impact of mortality on the population.

Graduate studies will be examining the survival of chicks in hopes of answering the question of why production is not as high as it should be. Studies are also planned to examine the dispersal patterns of ruffed grouse in the fall. Both of these studies will be conducted at West Virginia University.

By the time the research is completed the study should give researchers an idea of overall population trends, and shed some light on survival, mortality, productivity, and home range. This information will allow biologists to better manage grouse populations in West Virginia.

Where Have All The Ruffed Grouse Gone?
Ruffed Grouse Ecology and Management in the Appalachian Region (11 MB PDF)

RUFFED GROUSE ECOLOGY AND MANAGEMENT IN THE APPALACHIAN REGION

Final Project Report of the
Appalachian Cooperative Grouse Research Project

August 2004

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RUFFED GROUSE ECOLOGY AND MANAGEMENT IN THE APPALACHIAN REGION

Gary W. Norman, Virginia Department of Game and Inland Fisheries, P.O. Box 996, Verona, VA 24482

Dean F. Stauffer, Department of Fisheries and Wildlife Sciences, Virginia Tech, Blacksburg, VA 24061

Jeff Sole, Kentucky Department of Fish and Wildlife Resources, Kentucky Department of Fish and Wildlife Resources, #1 Game Farm Road, Frankfort, KY 40601

Thomas J. Allen, West Virginia Division of Natural Resources, P.O. Box 67, Elkins, WV 26241

William K. Igo, West Virginia Division of Natural Resources, White Sulphur Springs, WV 24901

Steve Bittner, Maryland Department of Natural Resources, 14038 Blairs Valley Road, Clear Spring, MD 21722

John Edwards, Wildlife and Fisheries Resources Program, Division of Forestry, West Virginia University, Morgantown, WV 26506

Roy L. Kirkpatrick, Department of Fisheries and Wildlife Sciences, Virginia Tech, Blacksburg, VA 24061

William M. Giuliano, Department of Wildlife Ecology and Conservation, Institute of Food and Agricultural Sciences, University of Florida, 366 Newins-Ziegler Hall, P.O. Box 110430, Gainesville, FL 32611

Brian Tefft, RIDEM, Division of Fish and Wildlife, Great Neck Road, P.O. Box 218, West Kingston, RI 02892

Craig Harper, Department of Forestry, Wildlife, and Fisheries, University of Tennessee, 2431 Joe Johnson Drive, Knoxville, TN 37996

David Buehler, Department of Forestry, Wildlife, and Fisheries, University of Tennessee, 2431 Joe Johnson Drive, Knoxville, TN 37996

Dan Figert, Kentucky Department of Fish and Wildlife Resources, #1 Game Farm Road, Frankfort, KY 40601

Mike Seamster, North Carolina Wildlife Resources Commission, 791 Seamster Road, Providence, NC 27315

Dave Swanson, Ohio Department of Natural Resources, 9650 State Route 356, New Marshfield, OH 45766

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Ruffed grouse populations have been declining throughout the Appalachian region for several decades. The Appalachian Cooperative Grouse Research Project (ACGRP) was established in 1996 by state natural resources agencies in the region to investigate potential factors limiting ruffed grouse populations. Hunting, particularly late season impacts, has been suggested as a potential cause of declining grouse numbers. Additionally, wildlife managers have suggested that the quantity and quality of ruffed grouse habitats have declined in recent decades.

Initial study sites and cooperators included Ohio, Kentucky, West Virginia, Maryland, and Virginia. Subsequently, sites and cooperators were added in Pennsylvania, North Carolina, and Rhode Island. Cooperators included state natural resource agencies and university wildlife programs from each state. Regular meetings were held to ensure that data were collected consistently across all study sites; the synergistic nature of the project ensured that the overall findings resulting from 12 study sites in 8 states would be greater than what could have resulted from any individual study area. The objectives of the ACGRP were to:

1. estimate survival rates and identify limiting factors for ruffed grouse populations,
2. estimate reproductive rates and identify limiting factors to reproduction,
3. determine if harvest mortality is compensatory or additive, and
4. evaluate habitat selection and quality.

Data were collected on 3,118 ruffed grouse captured on the 12 study sites from September 1996 through October 2002. Our general results indicated that the ecology of Appalachian ruffed grouse differs from northern ruffed grouse populations (i.e., Great Lake States) where aspen offers good food and aspen forest management creates an abundance of cover. Adult survival tended to be higher in the Appalachians, but

reproductive success was lower. Within the Appalachians, we found that grouse populations differed between areas dominated by mixed-mesophytic cover types and oak-hickory dominated sites. Specific, significant findings of the ACGRP include:

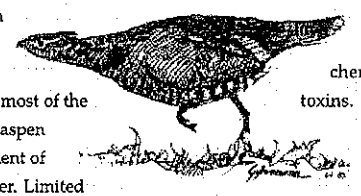
- Spring pre-breeding diets in Great Lake States ruffed grouse were dominated by aspen buds whereas in the Appalachians diets were more variable, with oak mast, herbaceous and evergreen leaves, and flowers being most prevalent. Appalachian diets tended to be of lower nutritional quality than that of northern birds feeding on aspen.
- The nutritional condition of females in the Appalachians prior to nesting was quite variable, and body fat levels showed a strong relationship to acorn availability, with higher body fat being found where acorns were available. When female body fat was less than 11% chick survival was lower.
- Cameras set on nests documented 5 nest depredation events by 3 species of mammals, and nest predation may impact overall nesting success.
- Nest success ranged from 52% to 87% across the sites and years studied. Successful nests tended to be over 100 m from openings in pole-size timber stands with dense understories.
- Chick survival was extremely low compared to studies from other areas. Chick survival to 35 days averaged 22%. Chick survival was higher on mixed-mesophytic sites (35%) than on oak-hickory dominated sites (21%).
- A radio-telemetry study of chick survival found that mortality of 118 chicks was evenly distributed between exposure (44%) and predation (44%).
- Nest and re-nest rates were lower in oak-hickory areas (86% and 3.2%, respectively) than in mixed-mesophytic sites (100% and 45%, respectively).
- Overall adult survival was 43% across all sites and years. Annual survival rates were higher on oak-hickory sites (50%) than mixed-mesophytic sites (39%). Survival was higher in the spring-summer period and lower in fall-winter, and did not differ between age or sex classes.
- We conducted a hunting experiment on 7 sites over the 6-year study. On 3 treatment sites hunting was closed the last 3 years of the study. These 3 sites had the highest hunting mortality rates during the first 3 years of the project. The other 4 sites served as control sites where hunting occurred throughout the study. Survival generally increased during the last 3 years of the experiment on both treatment and control study sites. However, we did not find evidence of an interaction effect or larger than expected increases in the treatment sites where hunting had been closed. We concluded that hunting mortality on these sites was compensatory. Hunting was only 12% of all mortality on average, and ranged from 0% to 35% across sites and years; we cannot conclude or infer that hunting would be compensatory at higher harvest rates.
- The primary cause of adult mortality was avian predation (44%) followed by mammalian predation (26%). A wide diversity of predators was observed on the study sites; only owls and Cooper's hawks sightings showed a relationship to predation rates of ruffed grouse.
- Ruffed grouse generally selected early successional habitats, or sites that had the high stem densities characteristic of early successional habitats. Females with broods selected sites that had higher than average herbaceous cover and greater arthropod abundance than random sites.
- Home ranges were calculated for 1,054 grouse based on 67,814 telemetry locations. Adult and juvenile females and juvenile males had larger home ranges than adult males. Females with broods had larger home ranges (39 ha) than females whose broods failed (15 ha). In oak-hickory sites, both female and male home ranges increased following years of acorn failure (20 ha to 52 ha in females and 7 to 27 ha in males).

Management suggestions include:

- Maintain current harvest levels and seasons; populations are not limited by current hunting levels.
- Increases in populations are most likely to come from habitat management. In mixed-mesophytic areas "traditional" early successional grouse management will likely be successful. This should emphasize using timber harvest techniques that will provide a diversity of young-aged stands interspersed among mature forests.
- In oak-hickory dominated sites, forest management should strive to provide both food (acorns) and cover (early successional habitat) needs of grouse in close proximity. Clearcutting, shelterwood, two-age, and group selection silviculture offers managers alternatives to create these contrasting needs of acorns from mature oak trees in association of cover from young stands.
- Roads can be managed by gating and planting preferred herbaceous foods to supplement existing natural foods.

INTRODUCTION

The ruffed grouse is a popular gamebird distributed from Alaska across central and southern Canada and the northern United States to the Atlantic Coast, south into the central Rocky Mountains and Appalachian Mountains. Its distribution coincides closely with that of aspen, except in the Appalachians. Throughout most of the range of the ruffed grouse, aspen is considered a key component of ruffed grouse diet and cover. Limited research conducted in the Appalachian region suggested ruffed grouse ecology and thus potential management differ greatly between the core of the species range (i.e., the Great Lakes and southern Canada region) and the Appalachian Mountains due at least in part to the absence of aspen. Breeding bird survey data from the U.S. Fish and Wildlife Service show a significant decline in ruffed grouse population indices over the last 35 years in both the Ridge and Valley and Alleghany Plateau regions of the Appalachians. These declines coincide with those of other early-successional bird species, and may be in part a result of changes in forest age over the last 35 years.



The nutritional quality of ruffed grouse diet differs markedly between the core range and the Appalachian region. Throughout most of their range, ruffed grouse depend on aspen (i.e., buds, twigs, and catkins) to meet their nutritional requirements. In contrast, ruffed grouse diets in the Appalachian region consist of the leaves and seeds of herbaceous plants, acorns, buds of beech, birch, and cherry trees, and fruits of greenbrier, grape, and numerous other soft mast producers. Diets of grouse in the Appalachian region tend to be higher in tannin and phenol levels, these chemicals serve as potential toxins. Additionally, Appalachian diets tend to have lower protein levels than the diets of grouse in the northern United States and Canada. The poor nutritional quality of grouse diets in the Appalachian region may result in increased foraging time and predation risk, and decreased body condition, reproductive potential, and chick survival.

In recent years, there has been a growing concern among wildlife managers, researchers, and hunters about the effects of hunting on ruffed grouse populations. In the Appalachian region, managers and researchers have been particularly concerned about the potential effects of late-season harvest (e.g., January and February), where hunting seasons tend to be longer than in the northern United States and Canada and the majority of the harvest is thought to occur during the late-season. Despite these concerns, little research has directly investigated the effects of regulated sport harvest on ruffed grouse populations.

The Appalachian Cooperative Grouse Research Project (ACGRP) was a 6-year research

effort initiated in spring of 1996 to investigate the decline of ruffed grouse in the Appalachian region. Primary cooperators included state natural resources agencies in Kentucky, Maryland, Ohio, Virginia, West Virginia, Pennsylvania, Rhode Island, and North Carolina, and departments of wildlife sciences or biology at Eastern Kentucky University, Ohio State University, University of Tennessee, West Virginia University, California University of Pennsylvania, Fordham University, University of Rhode Island, and Virginia Tech. The cooperative nature of the project resulted in one of the largest ruffed grouse research projects ever conducted and provided insight into multiple aspects of ruffed grouse ecology and management in the Appalachian region.

Prior to the initiation of the ACGRP, ruffed grouse management in the Appalachian region was based on research conducted in the northern United States and Canada. Differences in grouse ecology and longer hunting seasons in the Appalachians require management based on research specific to the region. The goal of the ACGRP was to investigate ruffed grouse ecology and provide information necessary for the successful management of the region's ruffed grouse populations. The objectives of the ACGRP were to:

1. estimate survival rates and identify limiting factors,
2. estimate reproductive rates and identify limiting factors,
3. determine if harvest mortality is compensatory or additive,
4. evaluate habitat selection and quality.

STUDY AREAS AND FIELD METHODS

We studied ruffed grouse populations on 12 sites in 8 states throughout the Appalachian region (Table 1, Fig. 1). Landownership varied across sites and included National Forest Land, state public land, and industrial land owned by MeadWestvaco Corporation. Study sites range in size from 2,000–11,000 ha. The proportion of forest age classes (sapling, pole, and sawtimber) varied across sites due to differences in past timber management activities. Timber management activities ranged from no active harvest to selective harvest and clearcutting. MeadWestvaco lands had the most active timber harvesting programs and thus the greatest proportion of sapling age stands. Hunting seasons typically ran from early October to late February with daily bag limits ranging from 1–4 grouse and possession limits of 4–8.

Study sites (except OH1 and OH2) were classified as either oak-hickory or mixed-mesophytic forest associations based on literature review, canopy tree composition, and abundance data collected as part of the ACGRP (J.

Table 1. Description of study sites participating in the Appalachian Cooperative Grouse Research Project, 1996–2002.

Study Area	Ownership	Counties	RPI[a]	Forest Type	Hunting Treatment[b]	Years
KY1	State	Lawrence	8.21	Oak-Hickory	Closed	1996–2002
MD1	State	Garrett	33.62	Mixed-Mesophytic	Open	1996–2002
NC1	Federal	Macon	32.4	Mixed-Mesophytic	N/A	1999–2002
OH1	State, Private	Athens, Vinton, Meigs	N/A	N/A	N/A	1996–1999
OH2	State, Private	Coshocton	N/A	N/A	N/A	1996–1999
PA1	State	Clearfield, Elk	35.96	Mixed-Mesophytic	N/A	1998–2002
RI1	State	Kent	25.54	Oak-Hickory	N/A	1999–2002
VA1	Federal	Augusta	25.0	Oak-Hickory	Open	1997–2002
VA2	MeadWestvaco	Botetourt	27.81	Oak-Hickory	Open	1996–2002
VA3	State	Smyth, Washington	33.13	Mixed-Mesophytic	Closed	1996–2002
WV1	MeadWestvaco	Randolph	34.73	Mixed-Mesophytic	Open	1996–2002
WV2	MeadWestvaco	Greenbrier	28.15	Oak-Hickory	Closed	1996–2002

[a]RPI = relative phenology index
[b]Hunting treatment refers to hunting experiment during last 3 years of project.

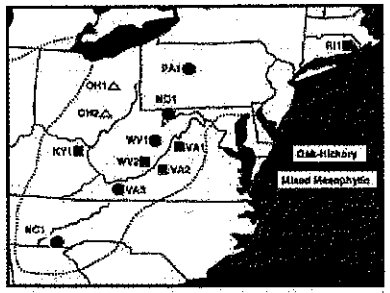


Figure 1. Location of Appalachian Cooperative Grouse Research Project study sites, 1996–2002. The dotted line indicates the distribution of ruffed grouse in eastern North America.

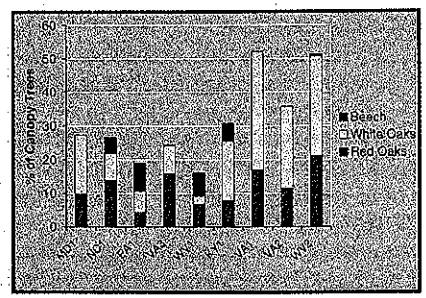


Figure 2. Percentage of canopy trees on ACGRP study sites represented by members of the red and white oak groups and American beech trees. Data were collected at randomly located 0.04ha plots (J. Tirpak, Fordham University, unpublished data; D. Whitaker, Virginia Tech, unpublished data). Sample sizes varied across sites: MD1 (n = 5,050 trees), NC1 (n = 5,587 trees), PA1 (n = 5,616 trees), VA3 (n = 7,259 trees), WV1 (n = 5,429 trees), KY1 (n = 3,825 trees), VA1 (n = 4,007 trees), VA2 (n = 6,142 trees), and WV2 (n = 7,804 trees).

Tirpak, Fordham University, unpublished data) and a Relative Phenology Index (RPI, Table 1). Oak-hickory forests were dominated by chestnut, white, northern red, scarlet and black oaks and shagbark, pignut, mockernut, and bitternut hickories. Other important tree species were red, sugar and striped maple; beech; table mountain, white, Virginia and pitch pine; and eastern hemlock. Mountain laurel and great rhododendron were important understory species. Dominant canopy species on mixed-mesophytic sites were sugar maple, red maple, yellow birch, basswood, black and pin cherry, yellow poplar, white pine, beech, northern red oak, and eastern hemlock. Other important species were white ash, white oak, and aspen. Hard mast producing species, including members of the red and white oak groups and beech were present on mixed-mesophytic and oak-hickory forests, but more abundant on oak-hickory sites (Fig. 2). Aspen, birch, and cherry were more abundant on mixed-mesophytic sites than on oak-hickory

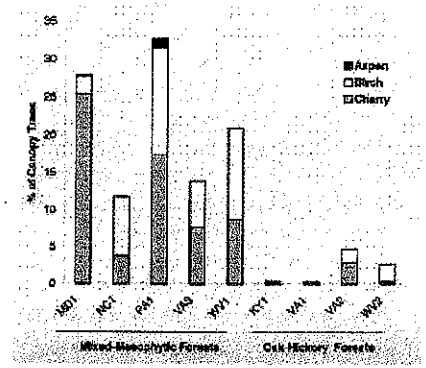


Figure 3. Percentage of canopy trees on ACGRP study sites represented aspen, birch, and cherry trees. Data were collected at randomly located 0.04ha plots (J. Tirpak, Fordham University, unpublished data; D. Whitaker, Virginia Tech, unpublished data). Sample sizes varied across sites: MD1 (n = 5,050 trees), NC1 (n = 5,587 trees), PA1 (n = 5,616 trees), VA3 (n,=,7,259 trees), WV1 (n = 5,429 trees), KY1 (n,= 3,825 trees), VA1 (n = 4,007 trees), VA2 (n = 6,142 trees), and WV2 (n = 7,804 trees).

sites (Fig. 3).

ACGRP personnel (here after "we") trapped ruffed grouse from August to December (fall) and February to April (spring) between 1996 and 2002 in lily-pad traps. We recorded the weight of each bird and determined age and gender based on feather characteristics. Birds were fitted with a uniquely numbered, aluminum leg band and a 10-g necklace style radio transmitter with an 8-hour motion detector then released at the capture site. After a 7-day acclimation period ruffed grouse were monitored ≥2 times per week to determine status (alive or dead), reproductive effort, and habitat selection.

We captured 3,118 ruffed grouse between fall 1996 and spring 2002 including 413 recaptures. The mean trap rate was 2.37 grouse/100 trap nights (Table 2). Trap success was greater for traps set near forest stand edges compared to traps set in mature forest stands. The ratio of juvenile grouse to adult females was 0.56 : 1.0 (Table 3). The sex ratio was slightly skewed and average 57% male (Table 4).

Table 2. Summary of ruffed grouse fall trap success in the central Appalachian region by study site, 1996–2002.

		Grouse/100 Trap nights				Flushes/100 Trap nights		
Study Area	n	Mean	SE	95% CI	n	Mean	SE	95% CI
KY1	6	1.41	0.314	0.60 – 2.21	6	0.60	0.215	0.05 – 1.15
MD1	5	2.17	0.482	0.83 – 3.51	5	1.81	0.454	0.55 – 3.07
NC1	3	0.89	0.135	0.31 – 1.47				
OH1	1	3.20			1	1.03		
OH2	2	4.59	0.930	0.0 – 16.41	2	1.66	1.050	0.0 – 15.00
PA1	4	6.00	1.23	2.06 – 9.92	4	1.98	0.201	1.34 – 2.62
RI1	3	1.23	0.289	0.0 – 2.48	3	0.51	0.182	0.00 – 1.29
VA1	5	0.87	0.168	0.41 – 1.34	5	2.22	0.384	1.16 – 3.29
VA2	6	1.06	0.322	0.23 – 1.88	6	1.27	0.236	0.66 – 1.88
VA3	6	1.13	0.065	0.96 – 1.29	6	0.35	0.087	0.13 – 0.58
WV1	6	3.00	0.391	2.00 – 4.00	6	2.13	0.481	0.90 – 3.37
WV2	6	4.71	0.551	3.29 – 6.13				

Table 3. Summary of fall ruffed grouse age ratios in the central Appalachian region by study site, 1996–2001.

	Juvenile : Adult Female				Juvenile Female : Adult Female			
Study Area	*n*	Mean	SE	95% CI	*n*	Mean	SE	95% CI
KY1	6	0.53	0.127	0.21 – 0.86	6	0.30	0.084	0.09 – 0.52
MD1	6	1.31	0.592	0.00 – 2.83	6	0.70	0.345	0.00 – 1.59
NC1	3	0.53	0.174	0.00 – 1.28	3	0.32	0.115	0.00 – 0.81
OH1	3	0.45	0.164	0.00 – 1.15	3	0.27	0.120	0.00 – 0.79
OH2	4	0.36	0.110	0.02 – 0.71	4	0.19	0.058	0.00 – 0.37
PA1	4	0.74	0.137	0.31 – 1.18	4	0.38	0.069	0.16 – 0.60
RI1	3	0.47	0.168	0.00 – 1.19	3	0.18	0.111	0.00 – 0.66
VA1	5	1.03	0.336	0.10 – 1.97	5	0.44	0.197	0.00 – 0.99
VA2	6	0.24	0.074	0.05 – 0.43	6	0.13	0.044	0.02 – 0.24
VA3	6	0.28	0.064	0.11 – 0.44	6	0.17	0.030	0.09 - 0.24
WV1	6	0.32	0.074	0.12 – 0.51	6	0.12	0.039	0.02 – 0.22
WV2	6	0.42	0.104	0.15 – 0.68	6	0.15	0.052	0.02 – 0.29

Table 4. Summary of fall ruffed grouse sex ratios in the central Appalachian region by study site, 1996–2001.

	Male : Female			
Study Area	*n*	Mean	SE	95% CI
KY1	6	1.77	0.398	0.99 – 2.55
MD1	6	1.19	0.224	0.75 – 1.63
NC1	3	1.04	0.206	0.64 – 1.45
OH1	3	1.44	0.366	0.72 – 2.15
OH2	4	1.37	0.129	1.06 – 1.57
PA1	4	1.25	0.232	0.79 – 1.70
RI1	3	2.66	0.547	1.59 – 3.74
VA1	5	1.76	0.586	0.61 – 2.91
VA2	6	1.22	0.154	0.92 – 1.52
VA3	6	1.32	0.225	0.88 – 1.77
WV1	6	1.70	0.182	1.35 – 2.06
WV2	6	2.14	0.744	0.68 – 3.59

FOOD HABITS AND NUTRITION

PRE-BREEDING FOOD HABITS OF RUFFED GROUSE IN THE APPALACHIAN REGION

by: Bob Long and John Edwards,
West Virginia University, and
William Giuliano, University of Florida

The food habits of ruffed grouse have the potential to affect behavior, movements, home range, survival, and reproduction and thus have gained a great deal of attention from researchers. Many studies have examined food habits during the fall and winter, when hunter-killed specimens are readily available and have documented the diverse diet of ruffed grouse in the fall and winter. These studies examine ruffed grouse food habits when foods are abundant and widely distributed. Late-winter and early-spring food habit information is less available, and few studies have investigated food use during the time when resources are limited. Some researchers have hypothesized that the late-winter and early-spring diet of ruffed grouse in the Appalachians may be deficient, limiting densities in the region.

We analyzed 401 crops to quantify the diet of ruffed grouse approximately 2–3 weeks before the initiation of egg-laying in the Appalachians and Lake States. We obtained 326 crops from birds collected on 8 ACGRP study sites (KY1, MD1, NC1, PA1, VA1, VA2, WV1, and WV2) in March and April 2000–2002 and 75 crops were analyzed from grouse collected in Michigan, Wisconsin, and Minnesota during the same time period. We separated individual crop contents into 11 forage classes and then developed an Importance Value (IV = [aggregate % mass / 100 + % occurrence / 100] / 2) to assess the relative importance of forage classes and individual foods on a scale of 0 to 1.

Pre-breeding diets of ruffed grouse inhabiting oak-hickory and mixed mesophytic forests in the Appalachians differ markedly from diets of Lake State grouse found primarily in aspen or aspen-conifer forests. Ruffed grouse collected in Michigan, Wisconsin, and Minnesota relied heavily upon aspen flower buds, which made up 46% of the crop contents (Fig. 4) and had an importance value of 0.38 (Table 5). Aspen flower buds were found in only 7 Appalachian grouse and all were collected in Pennsylvania in 2000. The PA study site was the only site that had a significant aspen component in the forest (Fig. 3). Buds, twigs, and catkins of northern hardwood trees and shrubs also were important forages in the northern region.

Herbaceous leaves and flowers such as strawberry and cinquefoil were consumed regularly and occurred in 80% of the crops of north-

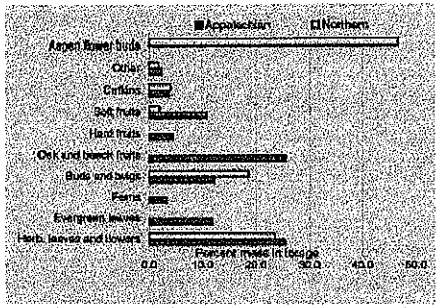


Figure 4. Percent mass of forage classes found in crop contents of Northern and Appalachian grouse collected in March-April 2000–2002.

ern grouse. Herbaceous leaf and flower use was similar in the Appalachians and accounted for 25% of total crop contents (Fig. 4). Consumption of herbaceous leaves and flowers may be related to spring green-up and the availability of other forages. On some sites, herbaceous leaf consumption varied significantly from year to year, most likely representing variations in the timing of spring green-up. Even when herbaceous plants are present, grouse may have selected other more preferred foods such as acorns. The overall importance of herbaceous leaves and flowers in the pre-breeding diet of Appalachian ruffed grouse is evident. Recently emerging leaves and flowers of species such as cinquefoil, strawberry, and coltsfoot are typically a readily available source of protein for pre-breeding hens and may contribute to the dietary needs of grouse in the weeks immediately preceding egg-laying.

Perhaps the most notable finding was the importance of oak and beech mast in the pre-breeding diet of Appalachian grouse. These hard fruits comprised the largest percentage of crop contents in the region (26%) despite being found in only 17% of the crops, suggesting acorns and beechnuts are consumed in large quantities when found. However, mast production patterns of oak and beech species are highly variable and do not provide a reliable food source. Acorns and beechnuts are among the most energy-rich forages available for grouse and appear to be highly selected for when available. The effects of mast production variability are difficult to assess, but may influence foraging times, predation, home range size, survival, body condition, and subsequent reproduction. Other hard fruits, such as maple samaras and witch-hazel seeds were relatively unimportant and accounted for a total of 5% of crop contents (Table 5).

Evergreen leaves, thought to be the poorest quality types of forage, were consumed regularly in the Appalachians, occurring in 36% of crops and accounting for 12% of the crop contents. Our analysis suggested that mountain laurel was often consumed when acorns were not eaten. Previous research has shown that ruffed grouse can maintain body mass with diets containing <20% evergreen leaves, but grouse consuming >40% evergreen matter will be unable to maintain body mass. We found 30 of 326 Appalachian crops with more than 40% evergreen leaves and 13 crops contained greater than 75% evergreen leaves. Whether or not these grouse had access to other higher quality foods is unknown, but if not, excess consumption of secondary toxic compounds present in evergreen leaves may be affecting as many as 10% of Appalachian grouse.

Table 5. Mean Importance Values [IV= (aggregate % mass / 100 + % occurrence / 100) / 2] of forages from crops of ruffed grouse collected in March and April, 2000–2002 in Michigan, Wisconsin, and Minnesota (North) and 8 study sites in the central Appalachians. Only forages with IV > 0.05 in at least 1 year are presented. Abbreviations are l. = leaves, fl. = flowers, c. = catkins, bt. = buds and twigs, fr. = fruit.

					SHE				
Forage	North	PA	MD	WV1	WV2	VA1	VA3	KY	NC
Alder c.	0.05								
Animal matter	0.10	0.06	0.05		0.04			0.02	0.02
Aspen fl.	0.38	0.10							
Avens l.	0.10	0.14	0.15			0.04		0.03	0.04
Azalea l.									0.02
Beech fr.		0.02		0.05				0.31	
Birdsfoot-trefoil l.		0.20			0.05		0.03		
Black birch bt.	0.04	0.07	0.11	0.05		0.02			0.06
Black birch c.		0.10	0.03	0.07		0.03			0.05
Blueberry / huckleberry bt.		0.22		0.04	0.19	0.09	0.11		0.07
Cherry bt.		0.04		0.02					
Cherry fr.			0.06						
Christmas fern l.			0.14	0.06	0.06	0.14	0.21	0.11	0.20
Cinquefoil l.	0.07	0.15	0.21	0.13	0.32	0.18	0.24		0.19
Clover l.	0.02			0.15	0.07	0.05	0.13		0.18
Coltsfoot fl.		0.16	0.03	0.06	0.07	0.12	0.23		
Dewberry l.		0.04		0.10		0.02			
Grape fr.		0.02							
Greenbrier fr.		0.02		0.11	0.08	0.07	0.04		0.07
Greenbrier l.				0.06	0.05	0.12	0.04	0.08	0.08
Hawkweed l.		0.04		0.14	0.14	0.06			0.05
Hornbeam c.	0.02					0.03			
Maple fr.		0.05	0.06		0.16	0.02	0.04		
Mountain laurel bt.				0.10	0.09	0.04	0.04		0.02
Mountain laurel l.		0.05		0.23	0.23	0.16	0.14		0.23
Multiflora rosa l.				0.06		0.03		0.10	0.09
Oak fr.		0.22	0.10	0.04	0.27	0.19	0.35		0.09
Pyrola spp. l.	0.12								
Ragwort l.							0.04	0.03	0.04
Serviceberry bt.		0.08	0.03	0.03	0.02	0.09	0.07		0.06
Sorrel l.			0.05						0.05
Strawberry l.	0.25		0.07				0.02		0.09
Sumac fr.		0.12	0.02					0.03	
Trailing arbutus l.		0.04			0.04	0.06	0.03		0.02
Viburnum spp. fr.						0.04			
Wintergreen fr.		0.03		0.06	0.05	0.07			
Wintergreen l.	0.02	0.03							
Witchhazel bt.				0.02	0.02	0.04			
Witch-hazel fr.			0.02	0.16	0.03				
Wood fern l.	0.07	0.23	0.15		0.04	0.04	0.02	0.07	
Yellow Birch c.			0.05						

Also, during late winter when herbaceous leaves were likely unavailable, evergreen leaf consumption may have been significantly higher than we detected, giving further credence to the hypothess theory that high-quality winter foods may be lacking in this region.

Soft mast was a moderately used forage class in the Appalachians and composed 11% of all crop contents in the region, although its abundance and distribution was variable among and within sites and years. Fruits of grape and greenbrier were the most common species found in this category, but other fruits such as sumac and cherry were also consumed. Buds and twigs were found in 47% of Appalachian crops but comprised only 12% of crop contents. Birch, cherry, serviceberry, blueberry, and huckleberry were among the most common species of buds eaten (Table 5). Buds and twigs are low-energy, high fiber food sources that are readily available when other more preferred species are not present. Other food classes, such as catkins, ferns, and animal matter were relatively unimportant components of the pre-breeding diet of grouse in the region.

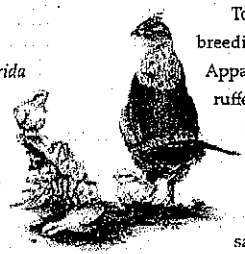
Overall, we found the pre-breeding food habits of Appalachian grouse to be substantially different from food habits of grouse inhabiting aspen-dominated forests in the Lake States. Because grouse densities reach their highest levels in aspen dominated forests, we can assume that the northern diet is adequate to meet their dietary and reproductive needs. However, the same cannot be said for grouse in Appalachia. We found pre-breeding diets to be highly variable among and within ACGRP study sites. When food habits data are summarized at a site level, it appears that the composite diet would be nutritionally adequate, but the results fail to capture the diets of individual grouse, which undoubtedly are more important than the "average" diet of the study site. We believe that pre-breeding diets of Appalachian ruffed grouse are strongly influenced by the cover types present in the home range of individual grouse and by annual patterns of mast production at the local level. Furthermore, the distribution of food sources between habitat types and among years may be an important determinant of grouse densities in the Appalachians.

Bob Long worked with the ACGRP from 1999–2002 conducting fieldwork on the Pennsylvania study site and researching ruffed grouse nutrition and condition. He holds a B.S. in Wildlife Science from Virginia Tech and is working towards a M.S. from West Virginia University. He is currently the Wild Turkey and Upland Game Bird Project Manager for the Maryland Department of Natural Resources.

FOOD HABITS AND NUTRITION

PRE-BREEDING NUTRITIONAL CONDITION AND POTENTIAL EFFECTS ON REPRODUCTION

by: Bob Long and John Edwards, West Virginia University, and William Giuliano, University of Florida



Poor pre-breeding physiological condition resulting from an inadequate winter diet has been hypothesized to contribute to low grouse densities in the Appalachians. Previous research shows that leaves of evergreen plants, fruits, and ferns compose the majority of the winter diet of grouse in the Appalachians, whereas grouse in the northern United States and Canada forage primarily on buds, twigs, and catkins of aspen and other northern hardwood tree species. When available, soft and hard mast is used extensively during the fall and winter months in the Appalachians, but significant annual and regional variations in mast production may limit its ability to sustain grouse through the winter. Winter evergreen forages used by grouse in the Appalachians have lower energy and protein levels than buds and catkins and contain toxic secondary compounds that may inhibit digestion. Poor quality late-winter diets in the Appalachians may adversely affect the physiological condition of breeding females and decrease reproductive success. The low chick survival and recruitment observed in the Appalachians may in part result from the poor condition of females entering the breeding season.

To better understand the role of pre-breeding nutritional condition in Appalachian grouse, we collected 352 ruffed grouse from 8 ACGRP sites in March and April 2000–2002 approximately 2–3 weeks prior to the egg-laying period. Additionally, we collected 80 grouse during the same time period in Michigan, Wisconsin, and Minnesota to compare the pre-breeding condition of ruffed grouse in the core range. We determined percent carcass fat, which is generally considered the most accurate index of nutritional condition. We then developed mathematical models to assess the effect of female condition on productivity.

Individual grouse carcass fat levels ranged from 1.3% to 39.7% with a mean of 9.9% and were highly variable both among and within sites and years and between sexes (Table 6). Female grouse consistently had greater percent carcass fat than did males (12.5 vs. 7.4%). This may be the result of male grouse spending less time foraging and more time with breeding activities as spring approaches. Grouse collected in the northern Lake States had lower fat levels (6.0%) than Appalachian grouse (10.8%).

To investigate the relationship between the pre-breeding diet and condition of ruffed grouse in the Appalachians, we conducted 3 separate analyses. First, we assessed 29 *a priori* models using food habits variables we hypothesized may

Table 6. Percent carcass fat of ruffed grouse collected March-April 2000–2002 at 8 sites in the central Appalachians and in Michigan, Wisconsin, and Minnesota.

Site	Year								
	2000			2001			2002		
Sex	*n*	Mean	SE	*n*	Mean	SE	*n*	Mean	SE
KY									
Female	3	11.2	1.6	2	28.3	4.3	6	11.7	1.5
Male	1	5.1	.	5	16.4	1.0	10	8.8	1.4
Combined	4	8.2	2.9	7	22.3	2.1	16	10.2	1.3
MD									
Female	7	12.9	2.5	7	8.0	1.6	5	25.9	2.6
Male	12	7.0	0.9	3	7.7	2.1	2	15.9	4.2
Combined	19	9.9	1.2	10	7.9	1.8	7	20.9	2.2
NC									
Female	8	5.6	1.0	9	11.7	2.2	7	8.8	1.3
Male	12	5.2	0.5	11	7.3	0.7	10	7.7	1.4
Combined	20	5.4	1.2	20	9.5	1.1	17	8.2	1.3
PA									
Female	8	15.1	2.7	7	8.6	2.1	8	16.2	2.9
Male	11	5.6	0.5	8	9.7	2.3	6	10.0	2.5
Combined	19	10.3	1.2	15	9.1	1.3	14	13.1	1.4
VA1									
Female	11	25.0	2.4	8	14.6	1.9	8	13.2	3.5
Male	5	9.8	1.6	16	10.5	1.0	9	6.9	0.6
Combined	16	17.5	1.4	24	12.5	1.1	17	10.0	1.3
VA3									
Female	12	15.6	2.4	6	10.1	1.8	8	27.0	1.0
Male	10	7.1	1.1	8	6.9	1.1	5	19.0	2.5
Combined	22	11.3	1.1	14	8.5	1.4	13	23.0	1.5
WV1									
Female	6	7.8	1.6	6	8.8	0.6	10	10.4	1.6
Male	8	5.1	0.7	2	14.6	8.0	7	6.9	1.7
Combined	14	6.4	1.4	8	11.7	2.1	17	8.6	1.3
WV2									
Female	5	12.0	3.0	7	7.2	0.9	6	14.0	4.4
Male	8	7.2	1.3	4	6.6	0.7	9	4.1	0.4
Combined	13	9.6	1.5	11	6.9	1.6	15	9.0	1.3
Northern States									
Female	16	7.9	0.9	15	6.7	1.0	5	7.3	3.0
Male	16	5.6	0.7	18	4.2	0.4	10	4.7	0.4
Combined	32	6.7	0.6	33	5.4	0.5	15	5.6	1.0

explain variation in carcass fat levels. We summarized food habits data and used food class Importance Values (IVs; see food habits section for description) as the explanatory variables to investigate variation in the mean percent carcass fat for each site/sex/year combination. Our data demonstrated a negative relationship between evergreen leaf and bud/twig consumption and fat levels and a positive relationship between oak and beech fruit, catkin, and fern consumption and fat levels. In our second analysis, we discovered a relationship between an index to mast availability and mean fat levels. We then assumed the presence or absence of acorns or beechnuts in the crop at the time of collection may reflect whether a grouse had access to hard mast throughout the winter period, which would increase the nutritional fitness of that bird. A third modeling analysis indicated the presence or absence of mast in the crops was an important determinant of fat levels. Females collected with mast in the crop contained 20% carcass fat, whereas females collected without mast in the crop only had 11.7% carcass fat (Fig. 5). A similar difference was found in males.

Our hypothesis that high acorn intake may increase fat reserves was supported by our findings. Acorns are a highly digestible source of energy and when abundant can satisfy the dietary needs of grouse with minimal foraging times which may also decrease exposure to predators. However, oak is not a major component of some Appalachian forests, and even when present, mast production is variable. When hard mast is not available, grouse forage more on less energy-rich foods such as buds, twigs, ferns, and evergreen leaves, which were negatively related to fat reserves.

Reproductive data were gathered at each site

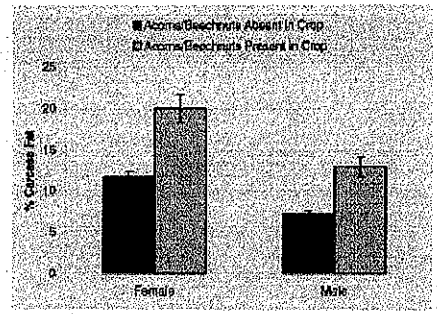


Figure 5. Percent fat of Appalachian grouse collected with and without acorns or beechnuts in crop during early spring, 2000–2001. Vertical bars represent the 95% confidence interval on the estimate.

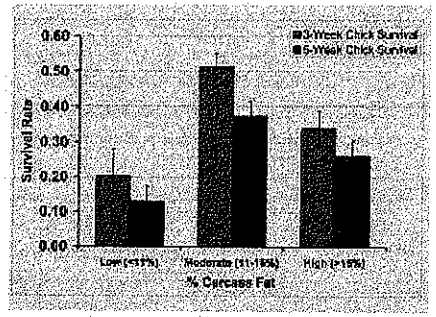


Figure 6. Ruffed grouse chick survival on study sites in the Appalachian region with low, moderate, and high levels of carcass fat. Vertical bars represent the 95% confidence interval on the estimate.

and we compared mean fat levels of female grouse to reproductive parameters for each site/year combination. Clutch size, hatching success and nest success all were positively related to percent carcass fat. Chick survival to 5 weeks also was positively related to the amount of carcass fat in

females, as was an index of recruitment. Sites with low mean fat levels had low chick survival rates at 5 weeks post-hatch (0.13) compared to sites with moderate (0.37) and high (0.26) fat levels (Fig. 6). Sites with moderate or high carcass fat levels had higher Recruitment Index values (2.87 and 2.09, respectively) than sites with low fat levels (1.17).

Our data suggest that reproductive success in the Appalachians is strongly influenced by several factors. The importance of site in many of our models suggests that some component of each individual site (e.g., habitat, predators, weather, etc.) has an effect on reproduction. Year-to-year variation may reflect regional weather patterns that impacted reproduction. Fat levels were positively related to nearly every aspect of reproduction that we measured. However, pre-breeding condition appears to be most influential on chick survival, particularly chick survival in the first few weeks after hatching. Our data suggest that survival and recruitment may be highest when grouse are in an "average" state of nutritional condition (approx 11–15% carcass fat), and that productivity may actually decline when grouse retain large amounts of body fat. Ruffed grouse with abnormally large fat reserves may have been feeding exclusively on high-energy, low-protein food sources such as acorns. Large amounts of both energy and protein are needed for reproduction and protein deficiencies may have resulted in lowered reproductive output. An alternate theory we suggest is that approximately 11% body fat represents a threshold level that is needed for successful reproduction in the Appalachians, and once that threshold is exceeded other factors become more influential than condition. Previous research supports the idea that nutritional deficiencies in laying hens can result in poorer quality eggs, low chick weights, and low chick survival in game birds. It should be noted that our analyses were limited to the site-level. The grouse we collected had to be sacrificed to obtain condition data, then the results compared to the reproductive success of other radio-tagged grouse in the same general area. We believe that if these coarse analyses detected such a pattern, an examination of the effects of condition at the bird-level may reveal an even stronger relationship and is surely worthy of additional research.

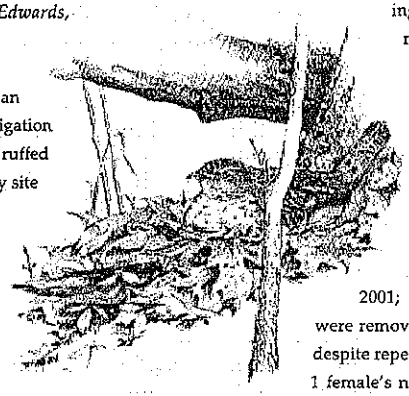
As a result of these findings the ACCRP has initiated further research on the effects of different nutritional diets (various energy and protein combinations) on reproduction. This study is being conducted on captive ruffed grouse at West Virginia University by Dr. John Edwards and Aaron Proctor.

Bob Long worked with the ACGRP from 1999-2002 conducting fieldwork on the Pennsylvania study site and researching ruffed grouse nutrition and condition. He holds a B.S. in Wildlife Science from Virginia Tech and is working towards a M.S. from West Virginia University. He is currently the Wild Turkey and Upland Game Bird Project Manager for the Maryland Department of Natural Resources.

NESTING AND REPRODUCTIVE OUTPUT

PREDATION OF RUFFED GROUSE NESTS IN WEST VIRGINIA

by Brian W. Smith and John Edwards, West Virginia University



We conducted an intensive investigation of predation on ruffed grouse nests on the WV2 study site via miniature cameras. The objectives of this study were to identify nest predators and investigate factors that influence nest predation.

We monitored 10 nests in 1999, 11 nests in 2000 and 4 nests in 2001 and observed 23 nest visitors (9 species, 3 taxa) to 13 ruffed grouse nests. Only 5 of 23 nest visits resulted in egg depredation; a black bear, 2 raccoons, a black rat snake, and long-tailed weasel were responsible for the observed nest predations. We recorded the 3 nest depredation events in 2000; in all cases, the female escaped predation despite remaining on the nest until the predator nearly captured them. One additional nest depredation event occurred at a nest with a camera, but power to the camera failed overnight and the event was not captured on tape. However, a raccoon was observed at the nest that morning when we arrived to change the videotape; we assume the raccoon was responsible for the nest loss. In 1999, a long-tailed weasel attempted to capture the incubating hen on 2 different nights but was unsuccessful; the weasel did not destroy any eggs on either visit. We also observed eastern chipmunks at 2 different nests in 2001; however, no eggs were removed from either nest despite repeated visits ($n = 5$) to 1 female's nest. We observed a shrew at 1 nest shortly after the female left the nest with her brood. The shrew removed all eggshells from the nest bowl, presumably to consume liquids and/or shell fragments.

During the egg-laying period, neither the amount of time females spent on or off their nests, nor total number of times they turned their eggs per hour differed by age of hen, nest outcome, day in nesting cycle, or associated interactions. During incubation, we determined that the length of time that females stayed on nests during the day increased as incubation progressed and the length of time that females were off nests decreased as incubation progressed. We found no differences in several egg-turning behaviors, with the exception that nighttime egg-turning activity changed throughout the nesting cycle, with peaks in egg-

turning activities during early and late incubation, and number of daytime egg turning events was influenced by female age. Females that lost their nest had a higher proportion of time on nests on the day of predation than all other days, but number of egg turning events per hour (total, daytime, or nighttime) did not differ. When compared to successful nests, hens that lost their nest had spent more time on nests on the day of predation than those that did not lose nests.

Nest predation may in be limiting grouse populations in the Appalachians, but it may also influence the evolution of their life-history traits. From this study, it appears that ruffed grouse nesting behaviors may have evolved in order to (1) reduce the probability of predation (i.e., infrequent trips to and from nests) and (2) maximize development rates of embryos (i.e., high nest attentiveness rates).

Brian W. Smith received a B.S. in Wildlife Management from Eastern Kentucky University in 1995 and an M.S. in Raptor Biology from Boise State University in 1999. He is currently the Wildlife Diversity Program Coordinator for Kentucky Department of Fish and Wildlife Resources, having recently transferred over as their Upland Game Program Coordinator. He is a Ph.D. candidate at West Virginia University, where his dissertation research focused on ruffed grouse nesting ecology, chick survival, and dispersal in the Appalachian Mountains.

NESTING AND REPRODUCTIVE OUTPUT

INFLUENCE OF NEST SITE SELECTION ON RUFFED GROUSE NEST SUCCESS IN THE APPALACHIANS

by John M. Tirpak and Bill Giuliano, California University, Pennsylvania.

Ruffed grouse populations in the Appalachians are experiencing declines that may be linked to poor recruitment. Nest success is an important component of ruffed grouse productivity, thus understanding the role microhabitat plays in determining nest success may be important for developing regional grouse management strategies. Therefore, we determined nest success (defined as the proportion of nesting hens that hatch ≥ 1 egg) rates, characterized nest site selection, and identified habitat characteristics associated with successful nests in the region. From 1996 through 2002, we collected habitat data at 234 known-fate nests on 8 study areas (KY1, MD1, PA1, VA1, VA2, VA3, WV1, and WV2) and at an additional 2,259 systematic points on the MD1, PA1, VA3, WV1 and WV2 sites. Nest success ranged from 52–87% for individual study areas and 58–78% for individual years. Overall, nest success averaged 63% (see reproductive section by P. Devers), a rate consistent with reports from other areas of ruffed grouse range. Females selected nest sites in sapling (<12.5 cm dbh) stands, near roads and openings (<30 m), and in areas with open canopies, dense herbaceous understories, and ample coarse woody debris. The selection pattern likely reflects the desire to nest under or adjacent to logs, while remaining concealed from predators in dense under-stories. Successful nests were more often located further (>100 m) from an opening, in pole (12.5–27.8 cm dbh) stands, and in understories with 21–60% woody and <30% herbaceous vegetation than unsuccessful nests. Alternatively, nests located near an opening, in sapling stands, and in open under-stories were more likely to be unsuccessful. Habitat characteristics associated with successful nesting did not parallel habitat selection patterns of females. Although nests located in dense under-stories were more likely to be successful, nests in sapling stands and near openings were more likely to fail. Because females selected dense herbaceous under-stories for nesting and realized higher nest success in these areas, we recommend partial over-story harvesting of pole and sawtimber stands to reduce basal area, open the mid-story and

canopy, and increase the understory vegetation and coarse woody debris loads of these stands. Provided logging roads into these stands are seeded, they would likely have minimal impact on nest success of ruffed grouse and can provide important brood foraging sites. Group selection cuts in small patches (<0.25 ha) may effectively create and maintain secure nesting cover without creating large canopy gaps or extensive sapling stands in close proximity to nesting habitat. We caution that neither of these practices can create sufficient early-successional stands for ruffed grouse or area-sensitive disturbance-dependent species, and our recommendations are only appropriate when applied in conjunction with large scale (>0.25 ha) even-aged harvests or large group selection cuts. Because the Appalachian landscape is primarily forested, fragmentation effects due to timber harvest may be minimal, and the diversity of many forest-interior species can be maintained.

John M. Tirpak is currently a Ph.D. candidate in the Department of Biological Sciences at Fordham University. He has been involved with the ACGRP for the last 5 years, receiving an M.S. in Biology from California University of Pennsylvania while working on the PA/01 site. Prior to that, he received his B.S. in Wildlife Management from West Virginia University. His research focus is the influence of habitat on population dynamics of ruffed grouse.

NESTING AND REPRODUCTIVE OUTPUT

SURVIVAL AND CAUSE SPECIFIC MORTALITY OF RUFFED GROUSE CHICKS IN THE APPALACHIANS

by Brian W. Smith, Chris Dobony, and John Edwards, West Virginia University

Although survival estimates and mortality causes of adult ruffed grouse can be readily obtained via radio telemetry, transmitter size and lack of reliable attachment methods have limited examination of these parameters for ruffed grouse chicks. Because mortality in ruffed grouse is highest during the first few weeks of life, understanding the factors influencing chick survival is important for their management. Many studies have addressed survival of subadult and adult ruffed grouse, but factors that influence chick survival have not been well documented. Arthropod abundance and availability, inclement weather, and predation influence chick survival, but to what extent each factor plays in the Appalachian Mountains is uncertain. Also, complete brood loss within a few days post-hatch appears more common in the Appalachians than in the northern portion of ruffed grouse distribution.

Therefore, we attached collar-type transmitters to ≤3-day-old grouse chicks to monitor survival and cause-specific mortality in the Appalachian Mountains. Specifically, we determined rates of exposure deaths, predation rates by various types of predators, other forms of mortality in ruffed grouse chicks, and survival to 5-weeks post-hatch at 3 study sites (PA1, VA2, and WV1).

From 2000 through 2002 we captured 177 chicks from 50 broods and equipped 139 of these chicks with transmitters (62 chicks on WV1, 40 on PA1, and 37 on VA2). Ruffed grouse chicks selected to receive radio transmitters had a mean weight of 14.7 g (when captured at 2–4 days post-hatch). We determined fates of 118 (85%) of the 139 radio-collared chicks, with 110 (79%) succumbing to some form of mortality and 8 (6%) surviving to 35-days post-hatch (Table 7). All chicks marked with necklace-type transmitters retained their transmitters until death or throughout the 35-day post-hatch sampling period, upon which they were captured and their transmitters removed. Exposure (44%) and predation (44%) were the leading causes of chick mortality, and were likely underestimates given the number of individuals with which we lost contact. The percent of mortalities that were mammalian (38%) and avian (33%) was similar. We lost contact with 15% (21 of 139) of the collared chicks; we were unable to determine if the transmitters failed or if the chicks were depredated. Therefore, predation rates and type of predator

represent minimum estimates. Of the 118 chicks with known fates, 8 (6%) survived to 35-days post-hatch and had their collars removed. Overall, survival of ruffed grouse chicks was extremely low and cause of mortality varied by

age and year.

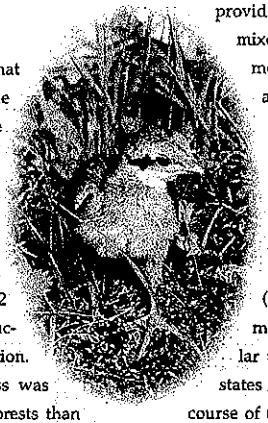
Brian W. Smith received a B.S. in Wildlife Management from Eastern Kentucky University in 1995 and an M.S. in Raptor Biology from Boise State University in 1999. He is currently the Wildlife Diversity Program Coordinator for Kentucky Department of Fish and Wildlife Resources, having recently transferred over as their Upland Game Program Coordinator. He is a Ph.D. candidate at West Virginia University, where his dissertation research focused on ruffed grouse nesting ecology, chick survival, and dispersal in the Appalachian Mountains.

Chris Dobony is currently a Fish and Wildlife Biologist on Fort Drum Military Installation in Fort Drum, New York. He makes up one half of the Fish and Wildlife Management Program at Fort Drum, and assists in the management of all natural resources, with specific focus on baseline species surveys and deer and beaver management. He received his B.S. in Environmental Forest Biology from the SUNY College of Environmental Science and Forestry (1997),and his M.S. in Wildlife and Fisheries Resources from West Virginia University (2000).

NESTING AND REPRODUCTIVE OUTPUT

RUFFED GROUSE REPRODUCTION AND PRODUCTIVITY IN THE APPALACHIAN REGION

by: Patrick K. Devers and Dean F. Stauffer, Virginia Tech



It has been long suspected that ruffed grouse in the Appalachian region have lower productivity and recruitment than grouse in the Lake States and southern Canada. To evaluate this we monitored 467 females during nest and brood seasons from 1997 through 2002 to estimate ruffed grouse productivity in the Appalachian region. Reproductive effort and success was greater on mixed-mesophytic forests than on oak-hickory forests (Table 7). Additional comparison of reproductive rates among oak-hickory and mixed-mesophytic forests and the core of the species range suggest oak-hickory forests provide low quality reproductive habitat, mixed-mesophytic forests provide intermediate quality reproductive habitat, and the northern hardwood forests provide the high quality reproductive habitat (Table7).

Nest rate (the proportion of females that attempt to nest) was lower on oak-hickory forests (86%) than on mixed-mesophytic forests (100%). Our estimates of nest rate on mixed-mesophytic forests were similar to rates reported in the Great Lake states and southern Canada. During the course of their study, Gardner Bump and his co-workers in New York reported 100% nest rate during 7 of 10 years, and suggested non-nesting females may be "physiologically upset and

Table 7. Comparison of reproductive parameters on oak-hickory and mixed-mesophytic forests in the central Appalachian region and northern hardwood forests of the Great Lakes region.

Parameter	Forest: Oak-Hickory	Forest: Mixed-Mesophytic	Lake States
Nest Rate	86%	100%	100%
Re-Nest Rate	32%	45%	>50%
Clutch Size	9.4 eggs	10.7 eggs	>11 eggs
Nest Success	63%	70%	>50%
Chick Survival	21%	39%	50%

unable to breed properly." Though they did not elaborate on what mechanism may cause females to by physiologically upset, several others have suggested that ruffed grouse in the Appalachians may be nutritionally stressed and enter the reproductive season in poor body condition (e.g., with lower lipid reserves) resulting in lower reproductive effort and success. The low nest rate of ruffed grouse on oak-forests forests compared to the high nest rate on mixed-mesophytic forests and northern hardwood forests suggests not all grouse in the Appalachians are nutritionally stressed, but rather only grouse inhabiting areas dominated by oak-hickory forests are nutritionally stressed.

Re-nest rate is defined as the proportion of females that lost their first nest and attempted to lay a second clutch. Research conducted in the Lake States reported re-nest rate of >50%. Our results indicate similar re-nest rates on Appalachian mixed-mesophytic forests (45%), but extremely low re-nest rate on oak-hickory forests (3.2%). Again, these results suggest female ruffed grouse on oak-hickory forests are nutritionally stressed and do not possess the required energy reserves (e.g., lipids and proteins) to lay a second clutch.

Nest success is defined as the proportion of females that hatched ≥1 chick in their first nest attempt. Nest success was lower on oak-hickory forests than on mixed-mesophytic forests, but similar to rates reported for the core of the species range (Table 8). The leading cause of nest loss was predation. Several species were documented as nest predators via miniature video cameras including raccoon, black snake, black bear, and long-tailed weasel (unpublished data B. Smith, West Virginia University).

Mean clutch size of first nests was lower on oak-hickory forests (9.4 eggs) than on mixed-mesophytic forests (10.7 eggs). Clutch size on mixed-

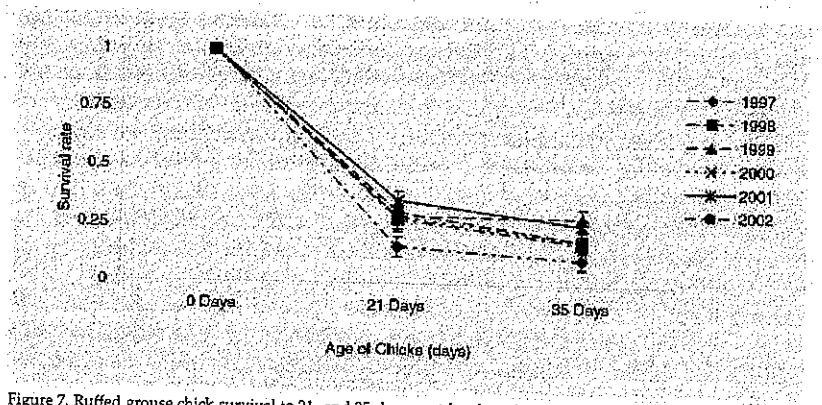


Figure 7. Ruffed grouse chick survival to 21- and 35-days post-hatch in the Appalachian region, 1997–2002. Vertical bars represent the 95% confidence interval on the estimate.

mesophytic forests was similar to clutch sizes reported in the core of ruffed grouse range (Table 7). Our finding of smaller mean clutch size on oak-hickory forests than on mixed-mesophytic forests further supports the contention that female grouse on oak-hickory forests may be nutritionally stressed and in poor body condition.

Biologists have suggested low chick survival is an important contributing factor to relatively low abundance of ruffed grouse in the Appalachian region. To assess this hypothesis we estimated chick survival to 35-days post-hatch. This was accomplished by first determining the brood size by counting the number of eggs that hatched and then flushing the female and counting the number of chicks alive at 21- and 35-days post-hatch. Chick survival in the Appalachian region was poor, averaging 22% to 35-days post-hatch (Fig. 7). Chick survival to 35-days post-hatch was higher on mixed-mesophytic forests (39%) than on oak-hickory forests (21%). In comparison, chick survival to 84 days (12 weeks) post-hatch in the Great Lakes region is ≥50%.

Chick survival was positively correlated with hard mast production the previous fall, providing additional evidence that ruffed grouse productivity and recruitment in the Appalachian region is strongly influenced by the quality and availability of food resources, especially hard mast. Food availability and quality is an important factor in successful reproduction in birds; he availability of high quality food improves female condition, egg quality, and chick survival. We suggest that in years with poor mast production females enter the reproductive season with fewer lipid and protein reserves and lay lower quality eggs (e.g., smaller yolks) which results in less robust chicks and lower survival to 35-days post-hatch.

Patrick Devers is a Ph.D. candidate at Virginia Tech studying ruffed grouse population ecology as part of the Appalachian Cooperative Grouse Research Project. He received his B.S. degree in wildlife biology from Colorado State University in 1997 and his M.S. in Renewable Natural Resources from the University of Arizona in 1999. Patrick will join the Conservation Management Institute at Virginia Tech after completing his degree in the fall of 2004. Pat's research interest include population ecology and monitoring, and the human dimensions of wildlife conservation.

SURVIVAL AND PREDATION

RUFFED GROUSE SURVIVAL IN THE APPALACHIAN REGION

by: Patrick K. Devers and Dean F. Stauffer, Virginia Tech

Adult survival is a critical component of population growth and viability. The ACGRP was initiated due to the concern over the decline of ruffed grouse in the region. Researchers and managers in the region were particularly concerned with assessing survival and the effects of hunter harvest on population viability. To this end, the ACGRP was designed to experimentally test the compensatory mortality hypothesis. The ACGRP hunting experiment was conducted on 7 study sites (Table 1) during the 6-year study. The study was separated into two 3-year phases. During Phase I (1996–1998) each of the study sites was open to normal hunting seasons and regulations. Hunting seasons typically ran from early October to late February with daily bag limits ranging from 1–4 grouse and possession limits of 4–8 birds. During Phase II (1999–2001) the 3 treatment sites with the highest hunting mortality rates in Phase I (KY1, VA3, and WV2) were closed to hunting, while the 4 remaining control sites remained open to normal hunting seasons and regulations. This experimental design allowed researchers to evaluate whether regulated sport harvest caused a decrease in annual ruffed grouse survival.

The average annual survival rate of ruffed grouse in the Appalachian region was 43%, but varied across forests associations, years, and seasons. Annual survival rate was greater on oak-hickory forests (50%) than on mixed-mesophytic forests (39%). Survival was highest in summer and lowest in winter in both forest types, but again seasonal survival rates were higher on oak-hickory forests than on mixed-mesophytic forests (Fig. 8). Seasonal survival trends were similar to trends reported throughout ruffed grouse range. There was no evidence that survival differed between adults and juveniles or between males and females. The leading cause of grouse mortality was avian predation, followed by mammalian predation, and predation by unidentified predators (Fig. 9).

Survival of grouse in both treatment and control groups tended to increase in the Phase II of the project (Fig. 10). However, we did not find evidence of an interaction effect or larger than expected increase in the treatment group where hunting had been closed. Over the 6 years ruffed grouse annual survival did not differ between

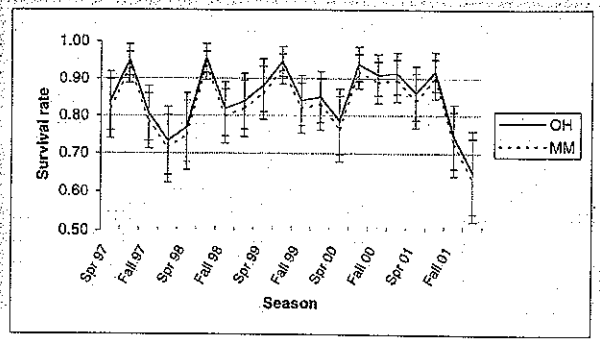


Figure 8. Ruffed grouse survival on oak-hickory and mixed-mesophytic forests in the Appalachian region, 1997–2002. Vertical bars represent the 95% confidence interval on the estimates.
OH = oak-hickory forests, MM = mixed mesophytic foests

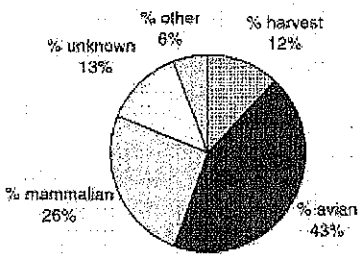


Figure 9. Percent of known ruffed grouse mortality by cause in the Appalachian region, 1997–2002.

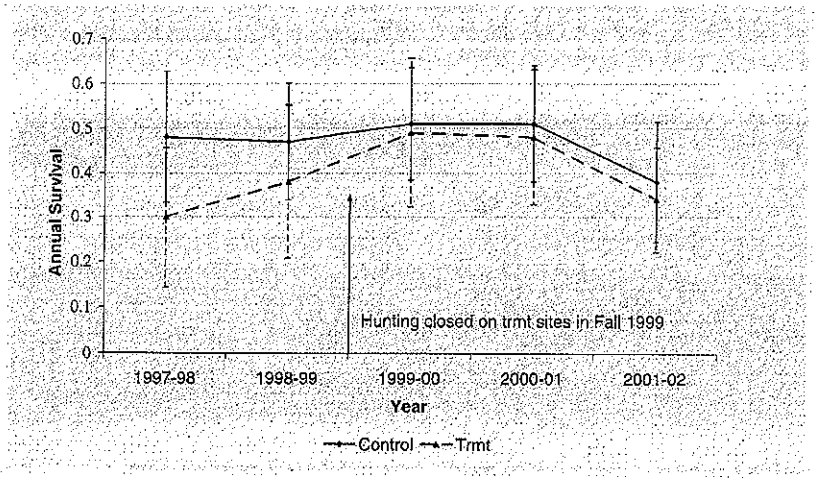


Figure 10. Ruffed grouse annual survival rates on control and treatment sites in the Appalachian region, 1997–2002. Vertical bars represent the 95% confidence interval on the estimates.

control and treatment sites, indicating regulated sport harvest did not cause a decrease in annual survival or abundance. Cessation of hunting on the 3 treatment sites did not result in increased annual survival among adult, juvenile, male, or female grouse. Harvest accounted for 12% of all known mortalities during the course of the study. Annual harvest rates ranged 0 – 35% and were lower than harvest rates reported in the core of ruffed grouse range, which may reach 50% or more. Hunting pressure on ACGRP study sites may have been influenced by publicity on the research project. Approximately 30% of the hunters interviewed on the WV2 site indicated they had never hunted there previously and had heard of the area through the research efforts (W. K. Igo, WVDNR unpublished data). Birds dispersing from the WV2 site had low hunter harvest rates (<3%, W. K. Igo, WVDNR, unpublished data). These survey data suggest that our harvest rates could be inflated because of increased effort at our study sites.

Ruffed grouse harvest was evenly distributed throughout the hunting season (Oct to mid-Feb) indicating harvest pressure was not greater in the late-season (Jan-Feb) than in the early-season (Oct-Dec). Observed harvest rates during this study were low compared to the Great Lakes region. Researchers in the Great Lakes region have concluded harvest mortality is compensatory and that grouse populations can support annual harvest rates between 30–50% of preseason population. Managers should be cautious in developing harvest regulations that increase harvest rates beyond those experienced during this study as harvest mortality above 30% may be additive.

Patrick Devers is a Ph.D. candidate at Virginia Tech studying ruffed grouse population ecology as part of the Appalachian Cooperative Grouse Research Project. He received his B.S. degree in wildlife biology from Colorado State University in 1997 and his M.S. in Renewable Natural Resources from the University of Arizona in 1999. Patrick will join the Conservation Management Institute at Virginia Tech after completing is degree in the fall of 2004. Pat's research interest include population ecology and monitoring, and the human dimensions of wildlife conservation.

SURVIVAL AND PREDATION

PREDATION ON ADULT RUFFED GROUSE IN THE APPALACHIANS

by: George Bumann and Dean F. Stauffer, Virginia Tech

Ruffed grouse in the Appalachian Mountains suffer their largest, natural losses to predation. Predation has resulted in behavior, physical attributes, and habitat use that reflect this long history with predatory animals. Quick flushing, wariness, agile flight, and cryptic coloration admired by the sporting and birding community alike, were developed in response, not to the dog and gun, but to hawks and foxes. The impact of predatory birds and mammals remains a prominent force in dictating the longevity of grouse in the wild.

The context in which one finds grouse is essential for understanding its relationship to predators of the region. Living on the southern tip of its distribution, the ecology and relation of grouse to predators in the Appalachians, differs from that of its northern relatives. The oak-hickory dominated forests of the southeastern U.S. lack persistent winter snows for snow roosting and predator avoidance, extensive aspen stands for escape cover and food, and periodic invasions by boreal birds-of-prey. Their use of moist hollows and rhododendron bottoms, ridge top mountain laurel, presence of annual migrations of birds-of-prey, in addition to regional trends in forest maturation, has important implications for the survival of adult grouse in the Appalachians.

Nearly all carnivorous animals in grouse range consume grouse as part of their diet. Some species come by a meal of grouse by accident while others appear to be more suited to the task of hunting ruffed grouse from the ground or air. Mammalian predator species including: red fox, gray fox, coyote, domestic dog, house cat, bobcat, raccoon, mink, weasel, fisher, striped skunk, opossum, and black bear, have been observed in and around AGCRP study sites. Avian predators present include: golden eagle, bald eagle, Cooper's hawk, sharp-shinned hawk, red-tailed hawk, red-shouldered hawk, broad-winged hawk, barred owl, great horned owl, and eastern screech owl. The Northern goshawk and great horned owls have been cited as skilled hunters of grouse yet the goshawk is largely absent from most of the Appalachians and most abundant during migration. ACGRP researchers reported fewer than 15 sightings of goshawks from February 1997 through December 2000.

Birds-of-prey are the most effective predators of ruffed grouse in the Appalachians. Other

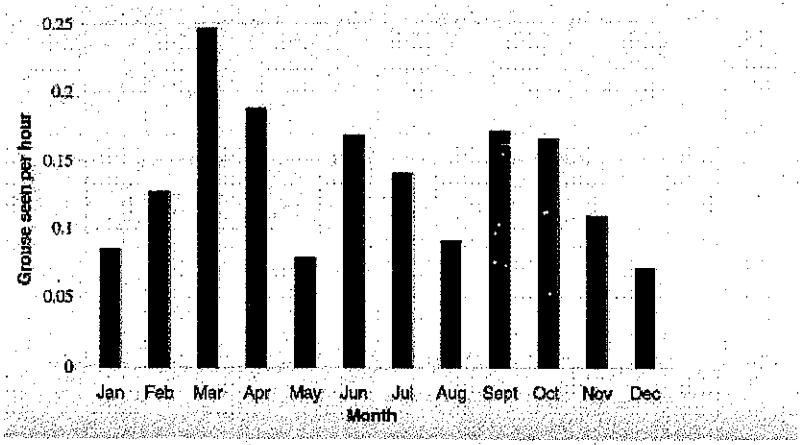


Figure 11. Summary of monthly observations ruffed grouse per hour across ACGRP sites from 1997 through 2000. Values are averaged across all study sites and all years.

investigations have indicated that mammal predators deserve credit for a significant portion of grouse death (especially with regard to nesting), yet our studies suggest that a large number of grouse assumed to have fallen prey to mammal predators may have initially succumbed to other causes such as hunter loss, accidental death, and hawk or owl predation. In this way, underestimation of the importance of raptors and overestimation of the role of mammal predators has likely occurred. Predation rates of raptors on grouse may actually be has high as 70–80% of all predation.

Other regions in the grouse range are impacted by periodic invasions by boreal hawks and owls, yet the Appalachians are too southerly to realize such affects. Alternately, spring and autumn raptor migration does result in seasonal increases in hawk and owl numbers. Fall movements also coincide with the fall brood break-up period when large numbers of inexperienced birds strike out on their own. Courtship and nesting activity in the spring also occur during the northward return of many migratory raptors; this coincidence results in the greatest proportion of the annual grouse population being visible and exposed to predation at this time (grouse numbers are at their annual low prior to the nesting season; Fig. 11). Understandably, peaks in predation on ruffed grouse, in the Appalachians, are situated during fall and spring, respectively (Fig. 12). September represents the month of greatest predator-related mortality in grouse. Predation rates drop during the winter months and then show a small peak in April. Despite the peak of predator observations occurring in sum-

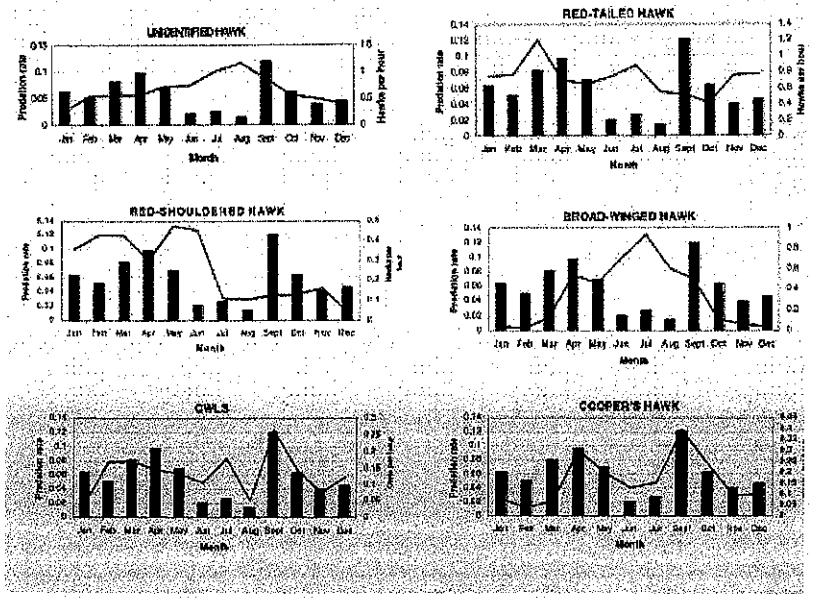


Figure 12. Monthly predation rate on ruffed grouse (vertical bars) and frequency of raptors (lines) observed by month pooled across sites and years in the Appalachians from 1997–2000.

mer (in large part due to repeat sightings of resident/nesting individuals and their young), this period represents a lull in predation on adult ruffed grouse.

The sporting public has long cited the coincidence of predator sightings and predation rates on game species however, empirical data supporting such assertions has been scarce. Over a period ranging from February 1997 through December 2000 ACGRP staff collected data to address the aforementioned issue. Grouse survival (monitored via radio-telemetry) and predator observations (4,281 sightings of species mentioned above) were logged during 43,994 hours of fieldwork and 207,332 miles of travel. The frequency of occurrence for our most important grouse predators (including red-tailed, red-shouldered, broad-winged, Cooper's hawks, and owls) was compared to the predation rates based on the survival component of the study. Increases in predation on ruffed grouse were only found to occur during increases in owl

(both great horned and barred) and Cooper's hawk observations (Fig. 12); all other avian predator sightings did not show a relation to grouse deaths (Fig. 12). From these results it appears that although we know most predators kill grouse at one time or another, owls and Cooper's hawk sightings coincided with increases on grouse predation.

Predators have been, and will always be a prominent source of morality in grouse populations. For future management it should be noted that focusing on predation from a habitat standpoint may prove far more feasible and effective than managing predator populations. Beyond that fact that many grouse predators are federally protected species, predator control alone has proved ineffective for widespread improvement of the game crop. Focusing on habitat quality and especially juxtaposition may be the most effective means of managing predator effects on the grouse population of the Appalachians. Older, more aggressive individuals may prove fit to hold the preferred territories in the limited amounts of higher quality habitat. Birds that select for habit composed of moist bottomlands, thick rhododendron and laurel thickets, and regenerating stands of hardwood move less and survive longer. The risk of predation when a bird is traveling in search of mates, territory, quality forage, etc. is much higher than sedentary individuals. Ruffed grouse that can fulfill all, or most of their needs in one locality (including finding mates, food, escape cover, brood habitat, nest sites etc.) will tend to wander less and become more familiar with their surroundings, hence less susceptible to fall to predation.

George Bumann, M.S. is a graduate of Virginia Polytechnic Institute and State University. His graduate research, in conjunction with the Appalachian Cooperative Grouse Research Project, focused on the predator-prey relationships of ruffed grouse in that region. He currently works as an instructor of art and natural history for the Yellowstone Association Institute in Yellowstone National Park. His writing and illustrations have appeared in several popular and scientific publications and are featured in this report.

HABITAT USE

RUFFED GROUSE HABITAT SELECTION AND HOME RANGE SIZE IN THE APPALACHIAN REGION

by: Darroch M. Whitaker, Todd Fearer, Scott Haulton, and Dean F. Stauffer, Virginia Tech

HABITAT SELECTION AT CLINCH MOUNTAIN WMA, VIRGINIA

Throughout their range, ruffed grouse are considered to be birds that like early-successional habitats. Sites with high densities of small woody stems and well developed herbaceous cover are selected by ruffed grouse. These conditions typically are found in young clearcuts and stands younger than about 20 years old. In the Appalachians, we also observed a preference for sites with a high stem density. When we compared habitat selection within home ranges to that area immediately surrounding the home range, we found that regenerations sites (clearcuts) were the most preferred cover type,

Table 8. Ranked preference of cover types by ruffed grouse based on a compositional analysis for home range and study site scales. Data were collected on the Clinch Mountain Wildlife Management Area, Virginia, 1996–1998. The lowest rank (1) represents the most preferred habitat.

Rank	Cover Types	
	Home range scale	Study site scale
1	Regeneration cut	Mesic deciduous w/ mixed understory
2	Mesic deciduous w/ mixed understory	Mesic deciduous w/evergreen understory
3	Mesic deciduous w/ evergreen understory	Regeneration cut
4	Meso-xeric deciduous	Meso-xeric deciduous w/ mixed understory
5	Mesic deciduous	Mesic deciduous
6	Meso-xeric deciduous w/ mixed understory	Meso-xeric deciduous
7	Xeric deciduous w/ evergreen understory	Xeric deciduous w/evergreen understory
8	Xeric deciduous w/ mixed understory	Meso-xeric deciduous w/evergreen understory
9	Meso-xeric deciduous w/evergreen understory	Xeric deciduous
10	Xeric deciduous	Mesic herbaceous
11	Mesic coniferous	Xeric deciduous w/ mixed understory
12	Xeric coniferous	Meso-xeric coniferous
13	Mesic herbaceous	Xeric coniferous
14	Other	Mesic coniferous
15	Meso-xeric coniferous	Other

and that mesic deciduous sites with either mixed or evergreen (rhododendron and mountain laurel) understory were also preferred (Table 8). When comparing home range conditions to those present across the landscape, these same 3 cover types were preferred, but in a different order. These cover types provide high stem densities in the understories, indicating that when early successional habitats are not available, ruffed grouse will then use sites in mature forest that provide the structural conditions (high understory stem densities) found in early successional habitats.

Brood habitat – Brood cover is a critical component of ruffed grouse habitat during a period when chick mortality may be high. We intensively studied the microhabitat and insect populations used by 25 broods in three study areas (VA1, VA2, and WV2). We compared characteristics at ruffed grouse brood locations with random locations to determine characteristics selected by females with broods.

Females with broods used forested sites with a well-developed overstory canopy (>70%). These sites had a higher abundance of arthropods in the first 3-weeks after hatch, taller ground cover and higher percent ground cover in the first 6-weeks after hatch than random sites. Total woody stem densities did not differ between brood and random sites, as has been found in several studies from more northern sites. It appeared females with broods were selecting areas with abundant, tall herbaceous ground cover that provides substrate for the invertebrates that constitute a critical food source for chicks. Sites selected by broods had higher abundances of invertebrates of the orders Coleoptera, Homoptera and Arachnida than random sites.

ROOST SITES

In northern regions, ruffed grouse conserve considerable energy during winter by burrowing under snow cover to roost. When conditions are unsuitable for snow burrowing, grouse almost invariably roost in conifers. We studied selection of winter night roosts by ruffed grouse on 3 study sites (VA1, VA2, and VA3) in western Virginia, a region where snow accumulation is variable and generally transient. Grouse almost always used ground roosts when snow was present (20 of 25 roosts were on ground), even though snow was never deep enough for snow burrowing. When snow was absent, grouse did not show any clear preference in roost microsite type (59 roosts, 29 on ground and 30 above ground), and were found roosting in and under deciduous and evergreen trees and shrubs, in brush piles, and in leaf litter. We hypothesized that this ambivalence to conifers was due in part to ubiquitous and persistent accumulations of fallen oak leaves, which likely afford grouse good thermal cover and concealment. Ruffed grouse were commonly found foraging at low elevations during daytime, but almost invariably roosted on midslopes or ridges (Table 10). This suggests daily elevational movements, likely to avoid cold air settling in low-lying areas during the night.

HOME RANGE AND HABITAT SELECTION

We also assessed factors that affect home range size in ruffed grouse. As animals are typically under selective pressure to use the smallest ade-

Table 10. Slope position of daytime and nighttime (i.e., roosting) grouse locations at 3 study sites in western Virginia, 1998–2002. Divisions between midslope and toe/bottom, and between ridge and midslope were one-third and two-thirds of the way up slopes, respectively. Columns represent the number of locations with percent of time locations in parentheses.

Site	Time of Day	Toe/Bottom	Midslope	Ridge
VA1	Night	4 (9)	18 (39)	24 (52)
	Day	63 (42)	63 (42)	24 (16)
VA2	Night	0 (0)	19 (73)	7 (26)
	Day	33 (22)	69 (46)	48 (32)
VA3	Night	4 (24)	6 (35)	7 (41)
	Day	43 (29)	51 (34)	56 (37)
Total	Night	8 (9)	43 (48)	38 (43)
	Day	139 (31)	183 (41)	128 (28)

quate home range, identifying factors associated with variability in home range size can provide important insight into a species' habitat ecology. We monitored 1,519 grouse at 10 study sites using radio-telemetry. We used 67,814 locations of radio-marked grouse to delineate 647 fall-winter (Oct-Mar) and 407 spring-summer (Apr-Sep) home ranges of ruffed grouse (Fig 13). Mean seasonal home range size differed by age and sex class (Table 10). Females that occupied smaller fall-winter home ranges were more likely to reproduce successfully during spring, and other researchers have reported higher survival for ruffed grouse using smaller ranges, supporting our assumption that home range size was inversely related to fitness.

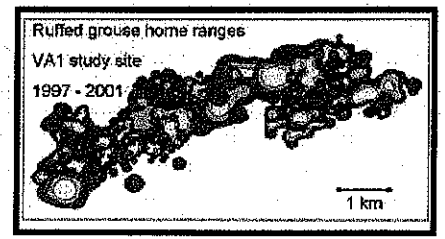


Figure 13. Home ranges of ruffed grouse monitored the Deerfield Site (VA1) in Augusta County Virginia, 1997–2001. Grouse home ranges were centered in the white areas where they were found most frequently (50% kernel home range). The lighter and darker green areas surrounding the 50% kernel home range represented the 75% and 95% kernel home range areas.

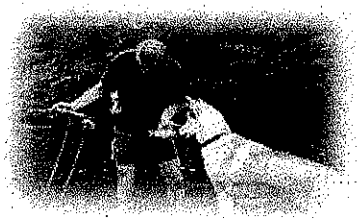
Numerous factors were associated with variation in home range size. Females and juvenile males occupied ≥2x larger home ranges than adult males, and female home ranges averaged 2.6x larger during breeding seasons when they successfully reared broods (39.2 ha, 75% kernel) than when they experienced reproductive failure (14.8 ha). Home range size of juvenile males was positively related to population density, supporting the hypothesis that they are in competition with established males for preferred territories. Clearcuts and forest roads generally are viewed

Table 11. Mean extent (ha) of 75% fixed kernel home ranges occupied by ruffed grouse during fall-winter (Oct–Mar) and spring-summer (Apr–Sep) at 10 study sites in the Appalachians, 1996–2001.

Forest Association	Juvenile Females			Adult Females			Juvenile Males			Adult Males		
	n	Mean	SE	*n*	Mean	SE	*n*	Mean	SE	*n*	Mean	SE
Oak-hickory Fall-Winter	5	32.7	8.5	5	32.1	4.2	5	29.7	9.1	5	12.4	2.4
Oak-hickory Spring-Summer	5	33.2	12.3	5	26.3	2.7	5	12.2	2.5	5	9.8	2.0
Mixed-mesophytic Fall- Winter	5	26.1	3.8	5	20.2	4.9	4	26.1	4.2	5	12.1	1.5
Mixed-mesophytic Spring-Summer	5	22.2	4.7	5	22.7	4.7	4	11.5	2.9	4	7.9	1.9
Regional Fall-Winter	10	29.8	4.9	10	26.2	3.6	9	28.1	5.1	10	12.2	1.3
Regional Spring-Summer	10	27.7	6.5	10	24.5	2.6	9	11.9	1.8	9	8.9	1.4

as providing high quality grouse covers, and both were more prevalent in smaller home ranges. In oak-hickory forests, female home range size was inversely related to proportional coverage of mesic bottomlands, which support relatively abundant herbaceous plant foods. Home ranges of males and females inhabiting oak-hickory forests increased 2.5x following poor fall acorn crops; with male 75% kernel home ranges increasing from 7.3 ha to 22.3 ha, and those of females increasing from 19.7 ha to 51.6 ha. In contrast, home ranges of ruffed grouse inhabiting mixed-mesophytic forests were unaffected by these factors. This supports the view that grouse populations in many Appalachian forests are under strong nutritional constraint and that good foraging habitats are localized. However, more dependable alternate foods (e.g., cherry and birch buds) may relax these constraints in mixed-mesophytic forests. Finally, all sex and age classes of grouse used smaller home ranges following closure of sites to grouse hunting, suggesting that hunters displace grouse from preferred habitats, at least temporarily.

A goal of many habitat studies is the identification of selected habitat features. However, favorability of a particular habitat type is likely contingent on such factors as landscape composition, predation risk, and an individual's immediate resource needs, so will vary depending on context. Identifying factors associated with variation in strength of selection for "preferred" habitat features could increase our understanding of functional aspects of a species' habitat ecology, for example by indicating when and why a habitat feature is important. It is widely recognized that clearcuts afford important escape cover for ruffed grouse, while access routes (roads) and mesic bottomlands are viewed as important foraging areas. Selection towards clear-cuts, access routes, and mesic bottomlands was interdependent; selection for clearcuts was positively related to selection for access routes, but negatively related to selection for mesic bottomlands. Ruffed grouse selected either clearcuts or for mesic bottomlands, but not both at the same time. Selection for mesic bottomlands and selection for access routes were positively related in oak-hickory forests, but unrelated in mixed-mesophytic forests. Other differences in selectivity were noted between these two forest types; clearcuts were more strongly selected in mixed-mesophytic forests, whereas mesic bottomlands were only selected in oak-hickory forests. Following poor fall hard mast crops, selection for access routes by female grouse increased. Strength of selection for all 3 habitat features was increased following closure of sites to hunting, suggesting that hunters discouraged use of otherwise preferred cover types. Taken together, our observations suggest that individual grouse make a tradeoff between favoring either survival or condition to maximize fitness, with males favoring refuging habitats, and females favoring foraging habitats. From this and other ACGRP studies (see sections by B. Long and P. Devers, this report) it is clear ruffed grouse endure considerable nutritional stress in oak-hickory forests, so they must seek out the best foraging sites and are particularly sensitive to size of fall acorn crops. In contrast, in mixed-mesophytic forests, where nutritional constraint is relaxed, all sex and age classes of grouse made greater use of escape cover (i.e., clearcuts).



Darroch Whitaker received his Ph.D. in wildlife science from Virginia Tech in 2003 studying ruffed grouse habitat selection in the Appalachians as part of the Appalachian Cooperative Grouse Research Project and is currently working as a Post-Doctorate at Arcadia University, Novia Scotia studying song bird communities. Darroch received a M.S. in Biopsychology from Memorial University of Newfoundland in 1996 and a B.S. in Resource Conservation and Environmental Forestry in 1994 from McGill University. Darroch's research interests wildlife conservation in managed forests, resource selection, and animal movements.

Todd Fearer graduated from Penn State in December of 1995 with a Bachelor of Science degree in Wildlife and Fisheries Science and minors in Forestry Science and International

Agriculture. He received his Master of Science degree in Wildlife Science from Virginia Tech in June of 1999. His research was part of the Appalachian Cooperative Research Project and focused on the relationship of ruffed grouse home range size and movement to landscape characteristics. He is currently pursuing a PhD at Virginia Tech where he is evaluating population-habitat relationships of forest breeding birds at multiple scales using Forest Inventory and Analysis data. His research interests include landscape ecology, GIS, upland gamebird ecology and management, conservation and management of early successional habitats, and forest-wildlife habitat relationships in oak forest ecosystems.

Scott Haulton is originally from upstate New York, were he received a B.A. in English and a B.S. in Environmental and Forest Biology. He attended Virginia Tech where he received a M.S. in Wildlife Science and studied ruffed grouse population ecology in managed forests in Virginia and West Virginia. After graduating, Scott worked briefly with DuPage County (IL) Forest Preserve District where he supervised their deer population management and browse monitoring program. In 2000 Scott returned to his home state, working with the State University of NY College of Environmental Science and Forestry's Adirondack Ecological Center in the Adirondack Mountains of northern New York. He developed research projects that investigated the effects of forest inanagement on wildlife populations and habitats and the impacts of deer and beaver herbivory on forest development. Scott is presently working with the Will County (IL) Forest Preserve District, where he continues his work with land management, deer population management, and monitoring the effects of herbivory on forested communities.

HABITAT USE

USE OF ELEVATION BY RUFFED GROUSE IN VIRGINIA AND PENNSYLVANIA

by: Joy O'Keefe and Steve Sumithran, Eastern Kentucky University

In the Appalachian region, ruffed grouse are found in rugged lands and usually at higher elevations. Drumming males preferred to display at sites on upper slopes or forest ridges. In winter, grouse varied their use of elevation on a daily basis in southwestern Virginia; birds moved upslope at night to avoid thermal inversions of cold air, which often settle in the mesic hollows where grouse feed during the day. The goal of this study as part of the ACGRP was to investigate ruffed grouse use and selection of elevation in the Appalachian region on 4 study sites (PA1, VA1, VA2, and VA3).

There were differences in use of elevation by sex and by age for Appalachian ruffed grouse in Virginia and Pennsylvania. Preferred elevation classes were typically mid to high elevation classes that also accounted for most of the available habitat at each site. Landcover may factor into these results, as clearcuts were often found in large proportions in the highest elevation classes at each site.

Season did not have an effect on use of elevation by ruffed grouse at any of the 4 study sites. Although ruffed grouse do not exhibit large-scale migratory moves, like some other gallinaceous birds, seasonal differences in their movements have been documented. We did not find an effect of age or sex on use of elevation by ruffed grouse at the VA1 study site. However, age was a significant factor at the VA3 site, and sex and age were significant factors in use of elevation for birds at PA1 and VA2. The combined effects of sex and age on use of elevation observed in this study correspond with existing

data on the ecology of ruffed grouse. Fall dispersal could account for some of the variability in use of elevation by juveniles, which tended to be distributed across a greater range of elevations than adults. Further, juveniles may move into lower quality habitat if higher quality habitat are occupied by higher ranking adult grouse. Adult males may exclude juvenile males from preferred ridgetop drumming sites. This behavior could explain the age-specific difference in preference for lower elevation classes at the VA3 study site.

Some of the sex-specific differences in use of elevation noted in this study may be explained by the tendency for females to make greater movements than males as they select breeding sites, brood habitat, and wintering areas. At sites classified as oak-hickory forest, hens with chicks may move to lower elevations to take advantage of mesic foraging conditions in local hollows (D. Whitaker. 2003. pers. comm.). Females were found more often at the lowest elevation class than males of the same age group.

Land managers should consider the age and sex-specific differences in use of elevation by ruffed grouse in the Appalachians when implementing silvicultural treatments. Distributing clearcuts among multiple elevation classes with some semblance of connectivity between clearcuts might make them more accessible to subdominant juveniles that may be forced down to lower levels. At all elevation classes, land managers should strive to maintain an interspersion of multiple cover types of various sizes and shapes to maximize suitability for ruffed grouse.

Joy O'Keefe is a graduate student at Clemson University in SC, studying bat communities in the mountains of NC. Before coming to Clemson, Joy worked as a biologist and environmental educator with East Kentucky Power in Winchester, KY. In addition, Joy completed her master's degree at Eastern Kentucky University, studying the use of elevation by Appalachian ruffed grouse as part of the ACGRP. Joy has developed a passion for sharing her knowledge and learning more about the diverse natural resources of the Southeast.

MANAGEMENT RECOMMENDATIONS

POPULATION MANAGEMENT

By: Patrick K. Devers, Dean Stauffer, and Gary W. Norman

A primary goal of the ACGRP was to identify factors limiting ruffed grouse populations, with particular emphasis on determining the role of harvest in population dynamics. The experimental design of the ACGRP provided a unique opportunity to investigate the influence of harvest on ruffed grouse population dynamics and supported the hypothesis that harvest mortality is compensatory. This finding indicates current harvest regulations and seasons are not limiting populations. It is important to note the harvest rates observed in this study were low compared to published rates and may be an important factor in our determination of harvest mortality being compensatory. Furthermore, our harvest rates may have been inflated as some hunters hunted our study sites because of the ongoing research (W.K. Igo, WVDNR, unpublished data). The highest annual harvest rate was 30%, which is commonly suggested as a minimum sustainable harvest rate in the Great Lakes region. We urge caution in establishing harvest regulation that will facilitate harvest rates beyond 30% because we cannot assume our finding of compensatory mortality will hold above 30% harvest mortality rates. Though our findings indicated harvest mortality is compensatory, we also found evidence that hunter disturbance may alter ruffed grouse habitat selection which may ultimately reduce ruffed grouse productivity and survival. Based on these results, managers should gate or otherwise limit access to key grouse habitats on public areas with higher hunting pressure.

Beyond regulated sport harvest, our findings suggest ruffed grouse experience different selective pressures on oak-hickory forests and mixed-mesophytic forests. Ruffed grouse on oak-hickory forests exhibit higher survival than reported in the core of the species range, but also exhibit extremely poor productivity. In contrast, ruffed grouse on mixed-mesophytic forests exhibit survival and productivity rates similar to those reported in the Great Lakes States and Canada. Most notable of our findings was the relationship between mast production, female pre-breeding condition, and productivity, particularly chick survival. Though mast production was correlated with female pre-breeding condition and reproduction on both oak-hickory and mixed-mesophytic forest, the relationship appears to be stronger on oak-hickory forests.

HABITAT MANAGEMENT

By: Ben Jones and Craig Harper, University of Tennessee and Darroch Whitaker, Virginia Tech

ACGRP studies have identified a need to intersperse habitat types when managing for ruffed grouse. Important components of grouse habitat in the Appalachian region include mesic stands with herbaceous ground cover, early successional stands with high stem densities, mature

stands with mast producing trees, and forest roads with abundant legumes and other forbs. In his work published in 1972, Gordon Gullion outlined a forest management system that created a diversity of habitats favored by ruffed grouse in the Great Lakes region. Although the general framework is applicable, there are major differences between aspen-dominated stands and those forest types found in the Appalachians.

To maintain optimal grouse habitat, managers should concentrate on providing quality cover and food, juxtaposed to reduce necessary travel. In the Lake States, both requirements are met through even-aged management of aspen. Following Gullion's recommendation, a patchwork of small clearcuts implemented at 10-year intervals over a 40-year rotation maximized grouse density. In Appalachian forests, where aspen is largely absent and timber rotations are much longer (80–120 years), managers face a more daunting task of providing quality cover and diverse food resources over space and time. Still, maintenance of young stands interspersed among other successional stages and important habitat features is critical.

A most-important challenge for managers in the Appalachian region is to evaluate forest management systems and select techniques most effective in producing grouse habitat. Forest management systems are generally not limited on most private, industrial, and state-owned lands. However, public opinions about forest management practices often influence forest management policies on federal lands. Fortunately, several regeneration techniques can be used to improve grouse habitat depending on goals, sites conditions, and public comment.

CLEARCUT

An important feature of ruffed grouse habitat is stands with a high midstory stem density, which provide protective cover and, ideally, offer good foraging opportunities. Most clearcut stands are optimal for grouse from 6–20 years after regeneration, depending on the site. Consequently, clearcutting has often been advocated as the best silvicultural option for improving grouse habitat.

In mixed-mesophytic and northern hardwood forests, buds should provide grouse a stable supply of high-quality winter foods in regenerating clearcuts, and in these forest types, clearcutting is likely the most appropriate silvicultural method to improve habitat for ruffed grouse. In oak-hickory forests, hard mast (acorns and beechnuts) is a critical winter food for grouse. Clearcutting these forests creates early successional habitat, but limits mast production for a number of years. Therefore, it is important to juxtapose mature oak stands adjacent to clearcuts so foraging opportunities for acorns and other mast are not limited. Where advanced oak regeneration is found, clearcutting is an effective system for regenerating oak-hickory forests.

SHELTERWOOD

The shelterwood method has received considerable attention as a technique for regenerating oak and mixed hardwoods. Shelterwood cuts in hardwood stands typically occur in two or more stages – an initial cutting to establish a new age-class of regeneration and two or more removal cuts to release regeneration and provide for its development. In hardwood forests, shelterwood methods range from techniques carefully designed to control species composition (especially oaks), to more general applications in which variable numbers of trees are retained and stand conditions resemble those achieved through clearcutting.

Shelterwood cuts can benefit grouse in several ways. First, opening the forest canopy increases herbaceous groundcover, creating important brood and foraging habitat. Soft mast production is increased the first few years after harvest, providing an important food source, and midstory stem density increases later in the rotation, providing escape cover. Another benefit of the shelterwood method is retention of oak for a period of time in the current stand, and provision for oak regeneration in the future. Acorns are an important food for Appalachian grouse. Therefore, stands with mature oaks are a critical habitat component in the region. In North Carolina, radio-tagged grouse began using shelterwood stands 6 years after initial harvest, prior to removal of residual canopy trees (Fig. 13).

Although shelterwood systems can improve habitat, there are many factors to consider. On mesic sites, herbaceous groundcover conditions will be improved, though species such as yellow poplar and birch tend to outcompete oak regeneration. Despite a lack of oak in the future stand, presence of birch buds (an important winter food source) and herbaceous groundcover improve foraging habitat. To regenerate oak on mesic sites, a shelterwood cut that controls midstory and lower canopy density but leaves the main canopy closed has been shown to foster development of advanced oak reproduction, a prerequisite for oak regeneration. On somewhat less mesic sites where yellow poplar is a competitor, a shelterwood cut followed by prescribed fire or herbicide treatment has shown promise.

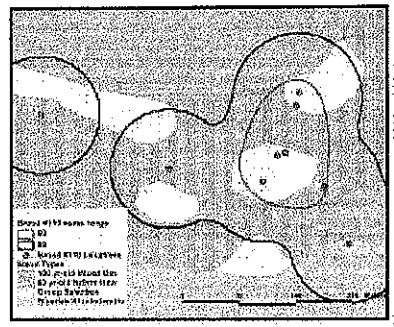


Figure 13. Kernel home range and locations of a ruffed grouse hen that used a 6-year-old shelterwood from October through February 2002 on the NC1 site, Macon County, North Carolina.

On dry sites, establishment of oak regeneration is less difficult. Although herbaceous groundcover will be less abundant, several species of oak including white oak, chestnut oak, black oak, and scarlet oak reproduce vigorously. Because of differences in acorn production among oaks, species diversity decreases the probability of complete hard mast failure in any given year.

TWO-AGE

The goal of the two-age method is to reduce basal area sufficiently in 1 or 2 cuts to provide for long-term development of regeneration while retaining some residual trees. A retention target of 20 sq ft/acre in dominant, co-dominant, and good intermediate crown class trees is typical. As the name implies, residual trees are retained beyond the normal period of retention for a conventional shelterwood, resulting in two distinct age classes.

The method used to create two-aged stands is often referred to as "shelterwood with reserves."

Retention of hard-mast producing trees makes the two-age approach a beneficial system for grouse. Following traditional clearcutting, there is a time lag in hard mast production while trees mature (at least 30 – 40 years). Over that period, grouse must strike a balance between time spent in early successional cover and time spent foraging among mature oaks. The two-age technique provides food and cover within the same stand, allowing grouse to forage on acorns without increasing predation risk. Other preferred grouse foods also increase. In West Virginia, dogwood, serviceberry, and pin cherry were present in two-age stands, and grape vines occurred in 58 percent of the co-dominant reproduction stems.

Similar to shelterwoods, grouse began using two-age stands on the North Carolina study site at 6 years post-harvest. Most use occurred from October through January. In May 2004 (7 years after harvest), a radio-tagged hen hatched a clutch in a two-age stand, and as this report went to press was raising her brood in an adjacent 75-year-old oak stand.

GROUP SELECTION

Group selection is a method that harvests groups of trees within a stand over time, creating a mosaic of small even-aged patches. With group selection, managers can maintain a percentage of early successional habitat across the stand while avoiding visual impacts of large clearcuts. Size of group harvests ranges from a small area occupied by a few trees to approximately 2 acres.

Reports of vegetation response to group selection cutting differ among Appalachian regions. In the central Appalachians, group size appears to determine stand composition and structure. As cut size increases, regeneration is dominated by shade intolerant species such as yellow poplar, while shade tolerant (sugar maple, beech) and intermediate species (oaks, hickory) fare better in small groups. However, in the southern Appalachians, yellow poplar, sweet birch, and red maple sprouts dominated regeneration in small group openings (<0.2 acres) on mesic sites.

Managers also must decide on the number or density of group selection cuts to place in a given stand. Specific information on this topic is not currently available, though the density of cuts should be low if the character of a mature stand must be maintained. Creation of one patch cut per 10 acres would place patches approximately 800 feet apart, and harvesting would remove 2.5 – 6.25 percent of the stand. Thus, grouse would be able to remain within about 400 feet of escape cover when foraging in a mature stand.

Regarding forest management for grouse, a primary concern is that group selection creates isolated pockets of habitat. A potential solution is to thin residual stands between groups. Thinning can soften edge effects and provide improved habitat conditions and connectivity between groups. Groups themselves also may serve as travel corridors. If positioned appropriately on the landscape, groups can provide patches of cover connecting otherwise disjunct habitats.

Group selection may be most useful in improving brood habitat. In North Carolina, brooding hens used edges of group cuts 4 years after harvest (Fig. 14). These groups contained abundant groundcover and were located within 80+ -year-old mixed oak stands – an important forest type for broods on the area. In addition, broods that used mixed oak stands lacking group cuts were often associated with canopy gaps, suggesting group harvests would be appropriate for enhancing brooding cover in these areas.

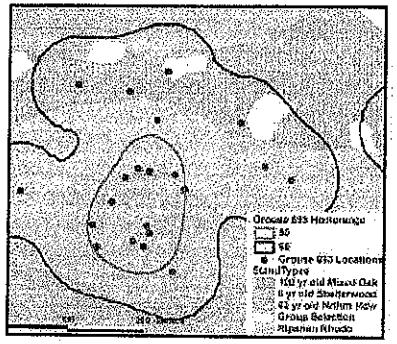


Figure 14. Kernel home range and locations of a grouse brood that used group selection cuts during the first 2 weeks post-hatch on the NC1 site, Macon County, North Carolina.

SIZE, SHAPE, AND PLACEMENT OF CUTS

There is a confusing abundance of literature concerning the optimal size of cuts for ruffed grouse. Cuts less than 2 acres have been recommended to improve brood habitat. Most authors report regenerating stands 1–25 acres in size are heavily used by grouse, allowing good interspersion of early successional habitats with other important features. Taking harvesting economics into account, some recommend larger cuts, up to 40 acres for oak-hickory forests. It seems grouse will use any size stand large enough to allow regeneration and recommending a single optimal size of cut is unwarranted. There are operational factors that need to be considered, but providing regenerating cover in a variety of sizes, ranging from 2–40 acres is most reasonable. Ultimately, the most important consideration is to maximize the availability of early successional forest cover throughout the landscape (within the bounds of the forest's capacity and rotation period), and the decision to create more small cuts or fewer larger ones is of lesser importance.

Little information is available regarding the most appropriate shape and placement of cuts for grouse. However, ACGRP research indicated grouse home ranges were smaller, suggesting higher habitat quality, if they contained regularly shaped cuts (when cuts were 12 acres or less). The position of cuts is largely dependent upon the forest type and site; however, positioning harvests in the mid-slope can provide important escape cover for grouse traveling between ridge-top drumming sites, roost sites, and bottomland foraging sites. Another most important consideration is to regenerate or, at least, thin stands along riparian zones, which are preferred habitats for ruffed grouse during winter and summer when a dense stem density is present.

PRESCRIBED FIRE

Although once commonly used, fire has been suppressed in the Appalachian region for some 80 years, altering many of the associated forest types and wildlife communities. Fortunately, forest and wildlife managers are realizing the positive benefits of fire and using it more often in Appalachian forests, especially to reduce fuels and foster oak regeneration as discussed previously. This has proven beneficial for ruffed grouse, particularly in oak-hickory forests where controlled burning can enhance brooding habitat.

On the North Carolina study site, fire was prescribed on an area primarily consisting of oak-hickory forest in March 2002. By 2004, the treated area (approximately 700 acres) supported a diverse herbaceous community, which was used almost exclusively by several grouse broods. Researchers in West Virginia also reported positive results with prescribed fire. Grouse broods in the Appalachians selected areas with abundant herbaceous vegetation, especially forb and fern cover, but also low-growing woody cover, such as blueberries and huckleberries. Brooding sites harbored more invertebrates than random sites, which provided a critical food source with available cover.

Prescribed fire in the Appalachians is restricted primarily to oak-hickory forests and other forest types associated with southern and western exposures and ridgetops. This offers numerous opportunities for habitat enhancement, especially where oak-hickory forests comprise 50 percent or more of the available forest cover. When burning oak-hickory stands, fire often feathers into coves and more mesic forests types, but intensity is much less and these areas rarely burn. In fact, when burning relatively large areas (200 – 500 acres; which is usually necessary on national forests where there is a lack of roads or firebreaks), coves, creeks, and northern/eastern exposures are commonly used as natural firebreaks. This provides an exceptional mosaic of conditions across the burned area, which is quite favorable for ruffed grouse.

Fire intensity is determined by fuel load and moisture content, wind, humidity, temperature, and atmospheric conditions. Managers should balance fire intensity with existing site conditions to create the desired habitat structure and composition. For example, a relatively cool fire may be used to consume the litter layer and promote an herbaceous understory, while a hot fire is necessary to reduce extensive coverage of mountain laurel and allow adequate light to the forest floor to stimulate the seedbank. Depending on stocking and percent canopy cover, thinning is sometimes desirable prior to burning. Basal area will fluctuate among sites, but reducing canopy closure to 60 – 80 percent should allow sufficient sunlight into the forest floor to develop the desired understory structure for brooding habitat and promote additional soft mast production.

The vast majority of burns in the Appalachians are prescribed during the dormant season, usually in late winter. Burning should be completed prior to nest initiation, which normally occurs in early- to mid-April in the Appalachians. This is quite important as the re-nesting rate for grouse on several of the ACGRP study sites was very low.

The historical occurrence of fire in the Appalachian region has been debated, but most researchers agree lightning- and Indian-ignited fires probably occurred every 3 – 25 years in those stands that would burn, depending on the site and climatic conditions. As related to habitat management for grouse, the structure and composition of the understory and midstory, fuel load, and the site determine fire rotation. On drier sites, it is not unusual for woody species to dominate the understory, while the understory on more mesic sites usually has a greater percentage of herbaceous cover. This can influence fire rotation. More frequent fire (every 2–4 years) on drier sites can be used to stimulate increased herbaceous cover.

FOREST ROADS

Forest roads (access routes) can provide important grouse habitat in the Appalachians. When seeded properly, access routes provide foraging areas, especially during years with a low mast crop. ACGRP studies found hens selected forest roads during fall and winter and during the breeding season. Therefore, roads should provide a nutritional food source during these times.

Grouse crops collected as part of the ACGRP study contained herbaceous material, dominated by clover, cinquefoil, birdsfoot trefoil, coltsfoot, and wild strawberry. Although orchardgrass was the predominant cover type on many forest roads, no orchardgrass was found in any of the grouse crops. In fact, of 326 crops examined from 6 states, no grass of any kind was found in measurable amounts. From this study, it is apparent access roads dominated by legumes and other forbs are most beneficial to grouse.

Many forbs are available in the seedbank, and managers can save time and money by taking advantage of this natural seed source. Following road closure, a good approach is to plant a mixture of clover and birdsfoot trefoil with an annual grass to stabilize soil – winter wheat is a popular choice because it is winter hardy and provides a desirable seed source. In acidic soils (pH<5.8), liming is necessary to retain clover and birdsfoot trefoil. Over time, pH will decrease and naturally occurring forbs from the seedbank will replace the planted legumes. Because of their tendency to out-compete clovers, perennial cool-season grasses (including tall fescue, orchardgrass, bromes, bluegrass, and timothy) should be avoided. Further, perennial cool-season grasses harbor fewer invertebrates, develop a dense structure and deep thatch that inhibits travel by broods, and provide a poor seed source when compared to planted legumes and naturally occurring forbs and grasses. The following seeding rate (per acre), has shown excellent results: 4 lbs. ladino white clover, 2 lbs. white-dutch clover, 2 lbs. birdsfoot trefoil, 40 lbs. wheat.

Benjamin C. Jones is a Ph.D. candidate in the Department of Forestry, Wildlife and Fisheries, University of Tennessee, Knoxville. He received his B.S. degree in Wildlife and Fisheries Science (Forest Science minor) from

Penn State, and M.S. degree in Wildlife and Fisheries Science from Mississippi State University. He is currently studying ruffed grouse use of forest stands harvested via alternative regeneration techniques in western North Carolina. Research interests include impacts of silvicultural prescriptions on wildlife and the use of forest management for improving wildlife habitat.

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SELECTED BIBLIOGRAPHY

Baines, D., and H. Linden. 1991. The impact of hunting on grouse population dynamics. Ornis Scandivacia 23: 245 – 246.

Barber, H. L., F. J. Brenner, R. Kirkpatrick, F. A. Servello, D. F. Stauffer, and F. R. Thompson. 1989. Food. Pages 268-282 *in* Atwater, S., and J. Schnell, editors. The wildlife series: ruffed grouse. Stackpole Books, Harrisburg, Pennsylvania, USA.

Beck, D.E. 1988. Clearcutting and other regeneration options for upland hardwoods. Proceedings of the 16th Annual Hardwood Symposium of the Hardwood Research Council. May 15-18, 1988, Cashiers, North Carolina, USA.

Beckerton, P. R., and A. L. A. Middelton. 1982. Effects of dietary protein levels on ruffed grouse reproduction. Journal of Wildlife Management 46:569-579.

Braun, E. L. 1950. Deciduous forests of eastern North America. Blakiston Company, Philadelphia, PA, USA.

Brose, P. and D. Van Lear. 1999. Using shelterwood harvests and prescribed fire to regenerate oak stands on productive upland sites. Forest Ecology and Management 113:125 – 141.

Bumann, G. G., and D.F. Stauffer. 2002. Scavenging of ruffed grouse in the Appalachians: influences and implications. Wildlife Society Bulletin 30:853-860.

Bump et al. 1947. The ruffed grouse: life history, propagation, and management. Telegraph Press, Harrisburg, Pennsylvania.

Clark, M. E. 2000. Survival, fall movements, and habitat use of hunted and non-hunted grouse in northern Michigan. Dissertation, Michigan State University, Lansing, MI, USA.

Dale, M.E., H.C. Smith, and J.N. Pearcy. 1995. Size of clearcut opening affects species composition, growth rate, and stand characteristics. USDA Forest Service, Research Paper NE-698, Northeast Forest Experiment Station, Radnor, Pennsylvania, USA.

Dobony, C. A., J. W. Edwards, W. M. Ford, and T. J. Allen. 2002. Nesting success of ruffed grouse in West Virginia. Annual Conference of Southeastern Association of Fish and Wildlife Agencies (In Press).

Dobony, C. A., and J. W. Edwards. 2001. A new flight-interception trap for arthropod sampling. Entomological News. 112:217-220.

Dorny, R. S., and C. Kabat. 1960. Relation of weather, parasitic disease, and hunting to Wisconsin ruffed grouse populations. Wisconsin Conservation Department Technical Bulletin 20.

Edminster, F. C. 1947. The ruffed grouse, its life story, ecology, and management. Macmillan Publishing, New York, New York, USA.

Ellison, L. N. 1978. Black grouse population characteristics on a hunted and three unhunted areas in the French Alps. The ecology of woodland grouse symposium.

Fearer, T. M. and D. F. Stauffer. 2004. Relationship of ruffed grouse *Bonasa umbellus* to landscape characteristics in southwest Virginia. Wildlife Biology. 10:81-89.

Fearer, T. M. and D. F. Stauffer. 2003. Relationship of ruffed grouse (Bonasa umbellus) home range size to landscape characteristics. American Midland Naturalist. 150:104-114.

Fettinger, J.L., C.A. Harper and C.E. Dixon. 2002. Invertebrate availability for upland gamebirds in tall fescue and native warm-season grass fields. Journal of the Tennessee Academy of Science. 77:83-87.

Fischer, C. A., and L. B. Keith. 1974. Population responses of Alberta ruffed grouse to hunting. Journal of Wildlife Management 38:585-600.

Gullion, G. W. 1965. Improvements in methods for trapping and marking ruffed grouse. Journal of Wildlife Management 29:109-116.

Gullion, G. W. 1970. Factors influencing ruffed grouse populations. Transactions of the North American Wildlife and Natural Resources Conference 35:93-105.

Gullion, G. W. 1972. Improving your forested lands for ruffed grouse. Ruffed Grouse Society, Rochester, New York, USA.

Gullion, G. W. 1984. Ruffed grouse management – where do we stand in the eighties. Pages 169 – 180 in W. L. Robinson, editor. Ruffed grouse management: state of the art in the early 1980s. North Central Section of the Wildlife Society, Bethesda, Maryland.

Gullion, G. W., W. H. Marshall. 1968. Survival of ruffed grouse in a boreal forest. Living Bird 7:117-167.

Harper, C.A., J.K. Knox, D.C. Guynn, Jr., J.R. Davis. 2001. Invertebrate availability for wild turkey poults in the southern Appalachians. Proceedings of the 8th National Wild Turkey Symposium. 8:145-156.

Haulton, G. S.*, D. F. Stauffer, R. L. Kirkpatrick, and G. W. Norman. 2003. Ruffed grouse brood microhabitat selection in the southern Appalachians. American Midland Naturalist. 150:95-103.

Hewitt, D. G., and R.L. Kirkpatrick. 1996. Forage intake rates of ruffed grouse and potential effects on grouse density. Canadian Journal of Zoology 74:2016 - 2024

Kalla, P. I., and R. W. Dimmick. 1995. Reliability of established sexing and aging methods in ruffed grouse. Proceedings of the Annual Conference of Southeastern Association of Fish and Wildlife Management Agencies 49:580-593.

Koenig, W. D., and J. M. H. Knops. 2002. The behavioral ecology of masting in oaks. Pp 129-148 *in* W. J. McShea and W. M. Healy, Eds. Oak forest ecosystems: ecology and management for wildlife, Johns Hopkins University Press, Baltimore, MD, USA.

Menge, H., T. Frobish, B. T. Weinland, and E. G. Geis. 1979. Effect of dietary protein and energy on reproductive performance of turkey hens. Poultry Science 58:419-426.

Myrberget, S. 1985. Is hunting mortality compensated in grouse populations, with special reference to willow grouse? 27th Congress of the International Union of Game Biologists, Brussels.

Palmer, W. L. 1956. Ruffed grouse population studies on hunted and unhunted areas. Twenty-first North American Wildlife Conference.

Palmer, W. L., and C. L. Bennett, Jr. 1963. Relation of season length to hunting harvest of ruffed grouse. Journal of Wildlife Management 27(4):634-639.

Reynolds, S. J., S. J. Shoech, and R. Bowman. 2003. Diet quality during pre-laying and nestling periods influences growth and survival of Florida scrub jay (*Aphelocoma coerulescens*) chicks. Journal of Zoology 261:217-226.

Rusch, D. H., S. DeStefano, M. C. Reynolds, and D. Lauten. 2000. Ruffed Grouse (*Bonasa umbellus*). *In* The Birds of North America, No. 515 (A. Poole and F. Gill, editors.). The Birds of North America, Inc., Philadelphia, PA., USA.

Rusch, D. H. and L. B. Keith. 1971. Seasonal and annual trends in numbers of Alberta ruffed grouse. Journal of Wildlife Management 35:803 – 822.

Schumacher, C. L., C. A. Harper, D. A. Buehler, and G. S. Warburton. 2001. Drumming log habitat selection by male ruffed grouse in North Carolina. Annual Conference of Southeastern Association of Fish and Wildlife Agencies 55:466-474.

Servello, F. A., and R. L. Kirkpatrick. 1987. Regional variation in the nutritional ecology of ruffed grouse. Journal of Wildlife Management 51:479-770.

Servello, F. A., and R. L. Kirkpatrick. 1988. Nutrition and condition of ruffed grouse during the breeding season in southwestern Virginia. Auk 90:836-842

Servello, F. A., and R. L. Kirkpatrick. 1989. Nutritional value of acorns for ruffed grouse. Journal of Wildlife Management 53:26-29.

Smith, B. W., C. A. Dobony, J. W. Edwards, and W. M. Ford. 2003. Observations of long-tailed weasel, Mustela frenata, hunting behavior in central West Virginia. Canadian Field Naturalist 117: in press.

Stafford, S. K., and R. W. Dimmick. 1979. Autumn and winter foods of ruffed grouse in the southern Appalachians. Journal of Wildlife Management 43:121-127.

Stoll, R. J., M. W. McClain, R. L. Boston, and G. P. Honchul. 1979. Ruffed grouse drumming site characteristics in Ohio. Journal of Wildlife Management 43:324 – 333.

Svoboda, F. J., and G. W. Gullion. 1972. Preferential use of aspen by ruffed grouse in northern Minnesota. Journal of Wildlife Management

Whitaker, D. M. 2003. Seeing Is Believing. Ruffed Grouse Society Magazine. Volume 15:1.

Whitaker, D. M., and D.F. Stauffer 2003. Night roost selection during winter by ruffed grouse in the central Appalachians. Southeastern Naturalist 2(3): 377–392.

THESES AND DISSERTATIONS
RESULTING FROM THE ACGRP

COMPLETED

Whitaker, D. M. 2003. Ruffed grouse (*Bonasa umbellus*) habitat ecology in the central and southern Appalachians. PhD Dissertation. Virginia Tech., Blacksburg, Virginia, USA. December 2003.

Endrulat, E. G. 2003. The effects of forest management on home range size and habitat selection of ruffed grouse in Rhode Island, Virginia, and West Virginia, USA. Thesis, University of Rhode Island, Kingston, RI, USA.

Bumann, G. B. 2002. Factors influencing predation on ruffed grouse in the Appalachians. MS Thesis, Virginia Tech, Blacksburg, Virginia USA. April 2002.

Fettinger, J. L. 2002. Ruffed grouse nesting ecology and brood habitat in western North Carolina. Thesis, University of Tennessee, Knoxville, Tennessee, USA.

Schumacher, C. L. 2002. Ruffed grouse habitat use in western North Carolina. Thesis, University of Tennessee, Knoxville, Tennessee, USA.

Dobony, C. A. 2000. Factors influencing ruffed grouse productivity and chick survival in West Virginia. Thesis, West Virginia University, Morgantown, West Virginia, USA.

Tirpak, J. M. 2000. Influence of microhabitat structure on nest success and brood survival of ruffed grouse in the central and southern Appalachians. Thesis, California University of Pennsylvania, California, Pennsylvania, USA.

Fearer, Todd M. 1999. Relationship of ruffed grouse home range size and movement to landscape characteristics in Southwestern Virginia. MS Thesis. Virginia Tech, Blacksburg, Virginia, USA.. May 1999.

Haulton, G. S. 1999. Ruffed grouse natality, chick survival, and brood micro-habitat selection in the southern Appalachians. MS Thesis. Virginia Tech, Blacksburg, Virginia, USA. June 1999.

Plaugher, G. F. 1998. Seasonal habitats, foods, and movements of ruffed grouse in the central Appalachian Mountains of West Virginia. Thesis, West Virginia University, Morgantown, West Virginia, USA.

PENDING

Devers, P.K. Population dynamics of ruffed grouse in the central Appalachian region. PhD Dissertation, Virginia Tech, Blacksburg, Virginia, USA.

Long, Robert. Nutrition of ruffed grouse in the central Appalachian region. M. S. Thesis, West Virginia University, Morgantown, West Virginia, USA.

Jones, B. C. Habitat selection of ruffed grouse in North Carolina. Ph.D. Dissertation, University of Tennessee, Knoxville, Tennessee, USA.

Smith, B. W. Ruffed grouse chick survival in the central Appalachian Region. Ph.D. Dissertation. West Virginia University, Morgantown, West Virginia, USA.

Tirpak, J. M. Ruffed grouse population influences in the central Appalachian region. Ph.D. Dissertation. Fordham University, Armonk, New York, USA.

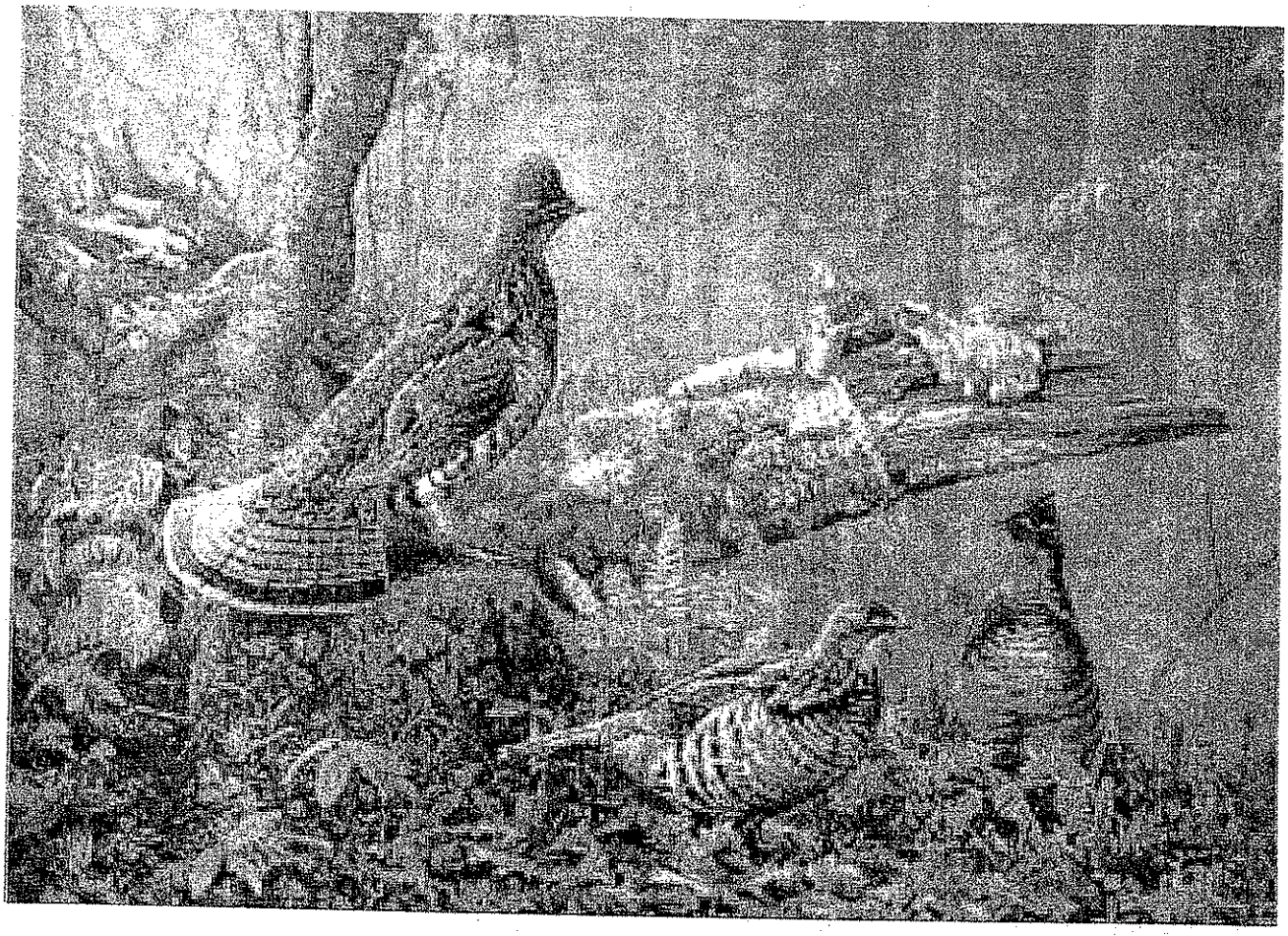
APPENDIX

Common and scientific names of animals and plants mentioned in the report.

Common Name	*Scientific Name*
MAMMALS	
Black bear	*Ursus americanus*
Bobcat	*Lynx rufus*
Coyote	*Canis latrans*
Domestic dog	*C. familiaris*
Eastern chipmunk	*Tamia striatus*
Fisher	*Martes pennanti*
Gray fox	*Urocyon cinereoargenteus*
House cat	*Felis catus*
Mink	*Mustela vison*
Opossum	*Didelphis virginiana*
Raccoon	*Procyon lotor*
Red fox	*Vulpes vulpes*
Shrew	*Sorex* spp.
Striped skunk	*Mephitis mephitis*
Weasel	
BIRDS	
Bald eagle	*Haliaeetus leucocephalus*
Barred owl	*Strix varia*
Broad-winged hawk	*Buteo platypterus*
Cooper's hawk	*Accipiter cooperii*
Eastern screech owl	*Otus asio*
Golden eagle	*Aquila chrysaetos*
Great horned owl	*Bubo virginianus*
Northern goshawk	*Accipiter. gentilis*
Red-shouldered hawk	*Buteo. lineatus*
Red-tailed hawk	*Buteo. jamaicensis*
Ruffed grouse	*Bonasa umbellus*
Sharp-shinned hawk	*Accipiter striatus*
REPTILES	
Black rat snake	*Elaphe obsoletus*
TREES AND SHRUBS	
Alder	*Alnus* spp.
Aspen	*Populus tremuloides*
Azalea	*Rhododendron* spp.
Basswood	*Tilia americana*
Beech	*Fagus grandifolia*
Birch, black	*Betula lenta*
Birch, yellow	*B. alleghaniensis*
Blueberry	*Vaccinium* spp
Cherry, black	*Prunus serotina*
Cherry, pin	*P. pensylvanica*
Eastern hemlock	*Tsuga canadensis*
Grape	*Vitis* spp.

Common Name	*Scientific Name*
Great rhododendron	*Rhododendron maximum*
Greenbriar	*Smilax* spp.
Hickory, bitternut	*Carya cordiformis*
Hickory, mockernut	*C. tomentosa*
Hickory, pignut	*C. glabra*
Hickory, shagbark	*C. ovata*
Hornbeam	Ostrya virginiana
Huckleberry	Baylussacia *spp.*
Maple, red	*Acer rubrum*
Maple, striped	*A. pensylvanicum*
Maple, sugar	*A. saccharum*
Mountain laurel	*Kalmia latifolia*
Multiflora rose	*Rosa multiflora*
Oak, black	*Quercus velutina*
Oak, chestnut	*Q. prinus*
Oak, northern red	*Q. rubra*
Oak, scarlet	*Q. coccinea*
Oak, white	*Q. alba*
Pine, pitch	*Pinus rigida*
Pine, table mountain	*P. pungens*
Pine, Virginia	*P. virginiana*
Pine, white	*P. strobus*
Serviceberry	*Amelanchier* spp.
Sumac	*Rhus* spp.
Yellow poplar	*Liriodendron tulipifera*
White ash	*Fraxinus americana*
Witch hazel	*Hamamelis virginiana*
HERBACEOUS PLANTS	
Avens	*Geum* spp.
Birdsfoot-trefoil	*Lotus corniculatus*
Christmas fern	*Polystichum acrostichoides*
Cinquefoil	*Potentilla* spp.
Clover	*Trifolium* spp.
Coltsfoot	*Tussilago farfara*
Dewberry	*Rubus hispidus*
Hawkweed	*Hieracium* spp.
Orchardgrass	*Dactylus glomerata*
Partridgeberry	*Mitchella repens*
Pyrola	*Pyrola* spp.
Sorrel	*Rumex acetosella*
Strawberry	*Fragaria* spp.
Trailing arbutus	*Epigaea repens*
Viburnum	*Viburnum* spp.
Wintergreen	*Gaultheria procumbens*
Wood fern	*Dryopteris cannyloptera*

2004-05 RUFFED GROUSE POPULATION STATUS REPORT



KENTUCKY DEPARTMENT OF FISH AND WILDLIFE RESOURCES

Prepared by
Brian Grossman
Wildlife Biologist

METHODS

The 2004-05 Ruffed Grouse Population Status Report is a compilation of three surveys that the Kentucky Department of Fish and Wildlife Resources (KDFWR) conducts annually to track the status of Kentucky's grouse population. First, a drumming survey utilizes KDFWR biologists to conduct 15-stop driving routes during the month of April to listen for and record the number of grouse drumming at each stop. Second, the Grouse Hunter Log Survey summarizes hunting activity and success of hunters across the state. Combining the information we receive from those two surveys, we can create population trends from flush and harvest data and track hunter effort and success. The Grouse Wing Survey provides samples that can be used to provide information about the age and sex ratio of the harvest.

Kentucky's 2004-05 ruffed grouse hunting season began Nov. 15, 2004 and ended Feb. 28, 2005 (106 days). Hunters were able to pursue grouse in 53 eastern Kentucky counties. An early grouse season was open on 7 wildlife management areas (WMA) from Oct. 1 to Dec. 31, 2004 (90 days). Those WMAs included Beaver Creek, Big South Fork National River and Recreation Area, Cane Creek, Clay, Dix River, Fleming, and Lake Cumberland.

GROUSE POPULATION STATUS

Drumming Survey – From a low in 2003, the number of drummers has increased dramatically over the past two years (Figure 1). Actually, the increase was 188%! The overall trend, however, is steadily declining, which is likely caused by the lack of forest disturbance. Many survey stops were once characterized by dense understories, but over time, they have developed into more mature stands of timber. The 2005 result of 6.7 drummers per 100 stops is well below the long-term average of 8.3 drummers.

Flush Rate – The flush rate increased by 10% in the 2004-05 season compared to the previous season (Figure 2). The 2004-05 flush rate of 1.00 birds per hour was above the long-term average of 0.93 birds per hour. Despite two consecutive years of increased flush rates, the overall trend of the grouse population based on flush rates is slowly decreasing. Flush rate data is the most reliable indicator of the grouse population if sample sizes are adequate.

HUNT AND HARVEST DYNAMICS

Hunt Characteristics - Hunter log cooperators (n=34) reported data from 569 hunts in 2004-05. The typical hunt was 3.8 hours long consisting of roughly 2 hunters. Dogs (average of 1.9 dogs/hunt) were used 99% of the time, and hunting parties harvested 0.8 grouse/hunt. Hunting effort increased steadily as the season advanced (Figure 3). Also, as the season progressed, hunters flushed more grouse/hour, but the harvest remained fairly constant (Figure 4).

Harvest Age and Sex Ratio – The percentage of adult and juvenile grouse in the harvest is an indirect measure of reproductive success. Hunters who submitted wings and rump feathers of harvested grouse helped us attain an estimate of the number of juvenile grouse killed per adult hen (Figure 5). The 2004-05 season estimate of 2.33 was significantly lower than the long-term average of 3.90. Males comprised 53% of the harvest, whereas females were 47% of the harvest. Less than 1% of the collected wings and rump feathers could not be sexed.

In general, the proportion of juveniles in the harvest is a poor indicator of population trend. For example, the highest recorded proportion of juveniles killed per adult hen occurred during the 1998-99 season. However, the flush rate that same season was the third lowest recorded since the survey began. The contradiction implies that the wing data is unreliable unless there was extremely high rates of adult mortality, which was unlikely. Also, the increasing trend in production should correspond to a growing population, but the flush data shows otherwise. The inexperience of juveniles makes them more susceptible to harvest, which further minimizes the reliability of the wing data.

OUTLOOK FOR THE 2004-05 GROUSE HUNTING SEASON

Kentucky grouse hunters can expect a below-average hunting season overall. Research has shown that the productivity of hens is linked to the fall mast crop. Simply, healthy hens lay better eggs and are better able to raise a brood. Last fall's mast survey showed the lowest mast production in 20 years, so we expect fewer juvenile grouse in the woods this fall. As always, there will be local areas where grouse are plentiful, and areas where grouse are scarce. Do you your homework, and give your boots a workout to find birds.

ADDITIONAL HELP IS NEEDED

Grouse hunters can improve the survey information used to track Kentucky's grouse population. First, more participants are needed. Please prompt your friends and neighbors to track their hunts and pass that information on to KDFWR. Forms are available from the Department (1-800-858-1549) or from the hunting regulations guide. Forms are also available from the Department website (http://www.fw.ky.gov) under "Grouse" in the small game section of "Hunting". We remain pleased with the Hunter Log Cooperator Survey and hope to see it expand with every passing season. If you submit wings, please remember to fill out a hunting log, too. If you choose to only participate in one survey, then complete the hunting log. We get the best and most reliable data from those efforts. The KDFWR Wildlife Division sincerely thanks the grouse hunters who have participated in the grouse surveys for many years. Your dedication makes this report possible and helps track grouse populations across the state.

"Exhibit B"

Comments Received Outside the Public Hearing

Steven J. Neher, Allen County, IN (Email: December 4, 2009)
I agree with all of the proposed turkey rule changes except for the extended archery late season.

Jon Eggen, Hendricks County, IN (Email: January 15, 2010)
I support the shortening of the ruffed grouse hunting season on public land. While I support the changes I must point out that the reason for the decline in the Ruffed Grouse population is not due to hunting mortality, it is due to the loss of habitat directly related to the aging of Indiana forest from early successional forest to a mature forest. If the number and size of timber cuts on these forests, on both DNR property as well as Federal land, is not increased the Ruffed Grouse and other woodland species will disappear from Indiana. Reduce the season but increase early successional habitat, i.e. make more clear cuts.

Paul Vice, Jackson County, IN (Email: February 26, 2010)
First, thank you for the proposal to increase fall turkey hunting opportunity in Indiana! As a bow hunter, I would like to offer a change proposal to the selected dates. Would like to see the state run the first archery segment of fall turkey season concurrent with early archery deer season....even if that means taking away days from the second archery turkey segment. We still have some leaf cover in November for bow hunters that need to get close to turkeys. Also, those days in November would not require the use of hunter orange. I can't imagine getting in bow range of wild turkeys while wearing hunter orange? If you need to take days away from the second segment to preserve the sixty day total, my suggestion would be on the front end (early December). That takes away days from the mandatory hunter orange period while allowing season to remain open during the Christmas/New Year holiday period.

Robert Walker, Anderson, IN (Email: February 27, 2010)
I am in favor of the proposed rule changes for fall turkey season. It will definitely give me more time in the fall to pursue turkey without interfering with deer hunting as much. Thank you. Keep up the good work.

Steven J. Neher, Allen County, IN (Email: March 1, 2010)
I am in favor of the increase in the counties for fall turkey. I am opposed to the December archery season. I am in favor of the increased gun season.

Doug Wigand, Hendricks County, IN (Email: March 2, 2010)
Great idea opening up the fall turkey hunting season to 60 days for archery. However, I would like to see it opened the entire fall season for archery.

Richard Hauguel, St. Joseph, IN (Email: March 20, 2010)

The October firearms proposal in St. Joseph County for hunting wild turkey would be welcomed and then monitored by the DNR to make sure the numbers were not hurt.

David Bright, Hancock County, IN (Email: March 30, 2010)
Grouse Hunting – Leave the season on public land alone, address the problem, no timber harvesting on public ground.

Turkey Hunting – I think it is too early to harvest hen's out of the Hancock/Rush County population.

Kevin Payton, Indianapolis, IN (Email: April 23, 2010)
I have been turkey hunting for the last six years. I have bought a license every year just to pretty much donate my money. First the prices on licenses are just outrageous and making it where you can't afford to hunt. Second the last three years I have gone out scouting in the spring up to 3 weeks before season. I toms have already started pairing up with hens as soon as April 1st. I'm a strong believer that the season needs to be something like the Illinois season where it comes in two weeks earlier. Or we need to have it from April 1st to may 1st. When there are 75000 licenses bought in one year and only 12000 of them are filled don't you think something might be wrong with that. The bird population is going way up and adding the fall season hasn't done anything. Apparently no one in the DNR offices are hunters and realize this problem. Adding the fall season hasn't done anything to the population. The spring season needs to be expanded by at least two weeks earlier. When there's warm weather early the birds snap into strutting a lot earlier. I don't see why no one catches on to this. Last year alone there was over a million dollars spent in unused licenses because by the time people get out and hunt its almost to late unless you catch a couple of toms not paired up yet. I have hunted in Monroe county, Greene county, clay county, Hendricks county, and Owen county. I have ran into the same problem each year. I get on a couple hot birds one or two days in a row but the pair up before I can get the kill. Deer season comes in way before the rut why not make turkey season similar to that. The season for deer doesn't open up right when someone comes to you and says this is the date. No one knows when they're going to strut but extending the season will allow a little more of that million dollar profit that Indiana makes from unfilled licenses to be filled and help the turkey population stay somewhat manageable without the fall season. It's hard to want to hunt turkey in the fall when its deer season. Any day of the week id rather kill a deer than turkey. I think the seasons need to stay separate. Spring for turkey. At least April 5th - May 15th perfect season. Long enough for every hunter to get out more. Deer seasons needs to be the only big game sport in the fall. Dates are good for bow but gun seasons needs to come in atleast2 weeks sooner and last until the end of November. Give everyone more time to fill the tags. Also a longer gun season for deer will help manage the herds. Simple enough I say do away with the fall turkey season. Make a longer spring hunt and allow a hen and bearded bird to be taken in the spring with one license. That will make everyone a little happier and make it easier for more kills.

Woody Williams, Warrick County, IN (Email: May 24, 2010)

I fully support the IDNR Fish and Wildlife proposals for wild turkeys. I do not grouse hunt, so I do not have any comment on that proposal.

The following comments were received by email on May 25, 2010:
Timothy G. Ryker, Batesville, IN
I am in solid favor of all of the proposals you have presented with one amendment. On Grouse, I would like to see it lowered to 1 bird. It seems to me the numbers are getting lower each year. I know that they are very cyclical as far as population, but it seems we may need to help them through this low time. We can always raise it when they bounce back.

Marshall Drake, Paoli, IN
Forget about the fall season altogether. As the birds are non-callable with bag limits filled by deer hunters not turkey hunters. If you want to expand and enhance the turkey hunting in Indiana expand the bag limit to 2 bearded toms in the spring!

Arthur William Denecke, Indianapolis, IN
I am opposed to expanding the fall turkey firearms season into a time that overlaps with the early archery deer season. I would prefer that if the season is to be extended to do that during the firearms deer season. Introducing firearms hunters during the early archery season, in my mind would very much detract from that season and also introduce potential safety issues.

Mike Nicoloff, Greenwood, IN
You got it all wrong. We don't want any fall season we're deer hunting. The only change we need is for the spring to open 7 to 10 days earlier.

Ben D Hendrix, Newburgh, IN
I have reviewed the changes and support the rule change that are proposed.

Kurt Barhdt, South Bend, IN
I am in total agreement with these proposed rules changes for the ruffed grouse and wild turkey seasons!

Marty Lee Jones, Vigo County, IN
I am opposed to ANY ruffed grouse hunting on public land until thepopulation of ruffed grouse significantly improves. Habitatmanagement for which ruffed grouse requires has become virtuallynon-existent over the past 15 years and needs to be improved first.

John R Bennett, Salem, IN, Twin Creek Outfitters
I think it's a great idea. The turkey hen population has gone wild in southern IN and anything we can do to harvest more hens is a great idea.

Jason Treesh, Clark, IN
The new regs look good I am all for expanding the season; I need weekend days available to hunt.

Michael Bonin, Ft. Wayne, IN
I agree with the proposed changes to the fall turkey hunting seasons and regulations. Allen County is not ready for changes to fall turkey regulations, as the populations are just beginning to take hold.

Dorvin Kintner, Remington, IN
Turkey limit of 2 spring hunt.

Steve Gore, Boonville, IN
I like some of the proposed changes to the wild turkey regulations, but not a proponent of adding a fall firearms season. I feel the added number of hunters will add more pressure to the deer, making them harder to "bag". It may offset gains made in deer population control. But it may be worth a try. I also feel that all state fish and wildlife refuge areas need to allow all day hunting for turkey as I see the population growing very well especially in the south where I am. They are even becoming a nuisance to some home owners. Again, it's worth a try. Thanks for reading this and for the work you are doing.

Gary L. Rayls, Switzerland County , IN
I like the gun season being longer in the fall. My Complaint!!!! The season needs to be 2 weeks earlier in the spring.

Bob Jacobs, Noble County, IN
It might be easier to just have a year round open season on the turkeys then you wipe out the population faster just like the deer herd in our area.

Adam Parsley, Lawrence, IN
As much as I hate to limit the time that more dedicated hunters than I can pursue grouse, I think we have to do something to help the grouse come back. If that means shortening the season, then so be it. I hope that there are other things - habitat rehabilitation, transplanting, pen raising birds—anything and everything we can do to increase grouse numbers we have to do. Good luck, and look forward to hunting more birds in the future.

John Shaffer, Yorktown, IN
I'm OK with the proposed changes on Turkey hunting....

The following comments were received by email on May 26, 2010:
Jef Barton, Porter County, IN
Longer seasons are always better especially for turkeys which can vary dramatically depending on weather conditions. With the season being so short now especially spring, weather can plan an important role. I saw more turkeys on my property after the season than during and strutting more after the season by about a week.

Thomas C Roach, Greene County, IN

I have no issue with MOST of the proposed changes; however I am STRONGLY against expanding the fall firearm season for Turkey. I have no issues with the bow season; I just feel the longer fall firearm season puts too much pressure on the hens.

Brian E. Catt, Johnson County, IN
Johnson Co. needs to be removed from the Ruffed Grouse hunt area as the population is almost gone. Fall turkey firearms should remain the same as currently set. The decimation of turkeys by raccoons and coyotes continues to hurt the population for a spring hunt. Increasing the hunt time in the fall will also lead to decreased hunting opportunities for the following spring hunt.

Joseph Collins, Martinsville, IN
Ruffed Grouse Season should be closed to allow low grouse populations to grow. Allowing more hunting will cause more harm than good by locally extirpating populations that have only a few birds left. A full grouse season closed for several years should protect remaining populations and allow them to grow.

Turkey firearms should be expanded to counties like Morgan County. The season should be extended.

Connie Clouse, Brown County, IN
I don't think the killing of turkey hens is a good idea. They are vital in the reproduction of our flocks and they have enough of a tough time hatching and raising their young to make it on their own. There just is not a good reason for it. Although the turkey seems to be doing good in IN; the killing of hens just does not help.

Timothy J. Hambidge, Warrick County, IN, Ruffed Grouse Society
I have no problem with the intent of the proposal to limit the hunting of grouse. We need to increase the population of the grouse. In that regard IDNR needs to reconsider its forestry policy and develop the habitat for the birds. Public education of the tree huggers would go a long way toward developing a forestry policy that would bring back the grouse. We know the grouse are down...now we need to figure out how to bring them back. Reduced hunting is one option but of more import is the development of appropriate habitat for them.

Byron Keith Clark, Switzerland County , IN
I agree with the proposed fall turkey proposals. However, spring turkey season comes in 1 week too late in Indiana!

Patrick Cira, St. Joseph, IN
I encourage you to allow gun hunting for turkeys in St. Joseph County this fall. We have a lot of turkeys in St. Joe County and to have another species to hunt in the fall along with deer and squirrels would be great

The following comments were received by email on May 27, 2010:
Christopher N. Demetriades, Dekalb County, IN

Understand hunter orange requirement for deer. Because of that overlap with late archery and late turkey season need to rethink whether the management is necessary on turkey population for that late in the season.

Joe Mullet, Westville, IN
I welcome the expanding of the wild turkey season. I would hate to see them get out of control population wise as they have in other states. My only other suggestion is that spring licenses be good for fall seasons if you don't harvest a bird. Making a lot of money with nothing harvested.

John Christopher, Indianapolis, IN
Turkeys have superior vision and color perception. Requiring a hunter to wear hunter orange while hunting turkeys is counterproductive; it may however, be realistic to require turkey hunters to display hunter orange while in transit to hunting areas.

The following comments were received by email on May 28, 2010:
William J Rankin, Effingham County, GA
I am a former Indiana resident and current non-resident spring turkey hunter in Indiana. I would like to see the bag limit increased to 2 turkeys with visible beards in the spring season.

Douglas B. Egenolf, Marion County, IN
1. Stop wasting money on more people parks in Indiana. Please spend the money I give you on areas that support wildlife.
2. I am not rich. So I have to save my money to do my hobbies. 2009, I gave Montana 5,000.00 dollars. In 2010 I am giving Michigan 5,000.00 dollars. In 2011, I am giving Kentucky 5,000.00 dollars. (Example) Kentucky set aside 16 counties to get the largest elk herd this side of the Mississippi! All I have to do is give them 10 dollars and they give me a chance to get drawn for Elk. The state of Indiana is losing big $$$$ money!!!!
3. You failed big time in regards to the Ruffed Grouse in Indiana. You need to take control of the Hoosier national, Yellowwood and Morgan/Monroe. Manage those areas for wildlife, grouse, deer, turkeys, not people! Then you might find that wildlife in the woods and not dead against a smashed vehicle.
4. You can shorten any season you want, to try and make it look like you are doing something right. It is going to take serious work and proper land management to get the upland bird hunting right in Indiana. You can do it but I am not sure this state is smart enough to do the right thing. One more thing: You would have to pay me to shoot four bonus does in Monroe county. What overpopulation of deer are you talking about? I am happy just to see some does. Once again I take my money out of state to see and do some serious hunting, wildlife watching.

Daniel Branch, Floyd County, IN (Email: May 29, 2010)
I would recommend not extending the fall turkey season rather increase the spring's season limit to 2 birds.

Tim Thorne, Goshen, IN (Email: June 1, 2010)

I support the creation of additional fall firearms turkey hunting but oppose any regulation that allows for hunting turkey in concert with the hunting of deer. I have seen that type of concurrent hunting in Virginia during the several years that I lived in that state (before it was discontinued) and can say that many turkeys were wasted – a result of incidental opportunistic shooting with inappropriate weapons. Additionally, I believe that the increase in hunter error and human injury dramatically increases when large game seasons run concurrently.

Robert Armstrong, Jeffersonville, IN (Email: June 6, 2010)
I like the additional time to fall turkey seasons. I just started hunting and found the fall season too short here in IN. I had to take time off work to fully enjoy the time hunting as the season was so short. Because of the shorter IN season, I ended up spending more time hunting in KY to enjoy their longer fall turkey season. I think the longer fall season will attract more hunters to the fall season and allow IN to capture more revenues from the money spent hunting in IN. I know it will keep me and my money on our side of the Ohio River.

Michael A. Jaworski, Saint Joseph, IN (Email: June 7, 2010)
In reading the proposal, it is understood that a Bow and arrow can be used from Oct. 1 thru the last day of the Fall Turkey firearms season& again from the Saturday following the regular Deer Firearms season through the first Saturday in January. Correct? Why is the fall firearms season here in St. Joseph County only proposed to be 4 days long, when there is an over abundance of Turkeys here? There are a lot of farmers, (especially in the South/West &West part of the county) that I have talked to who report seeing flocks of 50+ birds. In talking with these farmers, I have heard complaints from all of them concerning crop damage (especially now during spring planting season). This past Spring, I hunted Turkeys in open farm fields that only had a minimal amount of traditional "Turkey Habitat" and counted up to 30 birds a day. Talk about having tore-learn turkey hunting techniques!! The people who I hunt with and myself urge you to extend the firearms season for the maximum days allowed down state to help curb the turkey population before it becomes the problem the Deer did several years ago. Another solution would be to up the bag/possession limit to 2 birds per season (Spring and fall respectively). If a biologist wishes to contact me about the land owners complaining, or wishes to see the flocks first hand, please contact me.

Robert L. Weisgerber, Lafayette, IN (Email: June 9, 2010)
I'm opposed to any extension of the current turkey hunting seasons. There aren't the numbers of turkeys in Fountain County to support traditional fall/archery hunting. The breeding seasons haven't been good for the last several years and the numbers of juveniles have been almost nonexistent. Quit screwing around with the turkey seasons. "If it's not broken…don't fix it.

Gene Kuntz, Jasper, IN, Dubois County Sportsmen's Club (Email: June 11, 2010)
I am in favor of the proposed rule changes to allow an additional 7days to the early archery portion of the fall turkey season. I also support the addition of a second late archery turkey season to coincide with the late deer archery season. The expansion of the

fall turkey firearms season for an additional 7 more days is also something I support. I would also like to make an additional suggestion that hunters be allowed to harvest 2 turkeys in the fall. One tom and one hen or two hens.

Tom Bauters, Fulton County, IN (Email June 13, 2010)
Fulton and Kosciusko counties should also be added to the list given the turkey population in these two counties

Jeffrey Alan Ray, Indianapolis, IN (Email: June 13, 2010)
I believe that ruffed grouse season should be discontinued in Indiana until we have recreated a sustainable population. Conversations I have had with some people "in the know" within the DNR, indicated that our grouse population in Indiana is all but nonexistent. The drumming surveys I have read would seem to support this. Any action, other than suspending the Ruffed Grouse hunting season and then working to increase the population would be less than wise. I make these comments as a decade's long upland game hunter who would like to go back to woods and relive some of the glory days of my youth by pursuing a vigorous and abundant population of Ruffed Grouse.

Richard Ward, Starke County, IN (Email: June 15, 2010)
I am in favor of all changes proposed in regards to hunting grouse and turkeys.

Gary K. Jenkins, Hamilton, IN (Email: June 17, 2010)
I do not want to see the fall season expanded at all. For the past two years, and it appears to be three years, we have had a poor hatch. Now is not the time in add to the fall season where hens are subject to harvest. If the fall season is to be increased at least do so after the general population has had a chance to recover. I would guess you are not selling that many fall licenses if your intent is to create revenue. Most of your fall birds are being taken by lifetime license holders sitting on deer stands. I encourage you to stop the increase of fall hunting days in any fashion.

Rodger K Hendershot, Marion, IN (Email: June 17, 2010)
I do not think the Fall Turkey season should be increased. The past 3yrs hatch has been down and the hens should be put in less risk instead of being exposed to a longer Fall season.

Jon Eggen, Hendricks, IN (Email: June 18, 2010)
I support the shortening of the season only if there is a 5 year sunset provision. If after five years there is no evidence of change in mortality the season should be changed back to the current season. Current research shows that hunting of ruffed grouse has a very minimal impact on the population but habitat management has a huge impact. I would recommend that habitat management, as in clear cutting, be vastly increase on state forest lands.

William C. Ruddell, LaPorte County, IN (Email: June 23, 2010)

For the further success of our wild turkey and upland game bird populations it is reasonable to extend the seasons of these two resources. It allows more time to participate and I feel there will be little impact on these two populations.

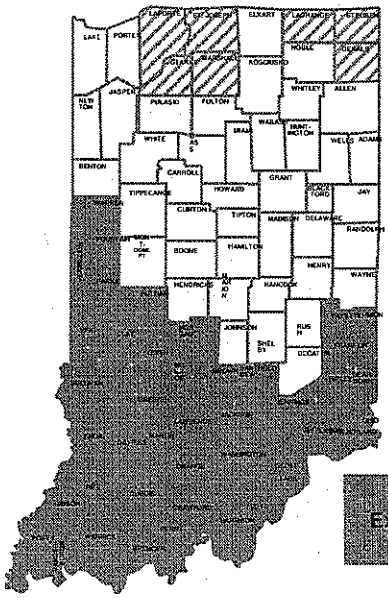
Patsy Fleetwood, Greene County, IN (Email: June 24, 2010)
I am in favor of this rule change. More needs to be done to help the falling grouse population. The turkey population seems to be in no danger and I am personally more likely to hunt with a firearm in the fall because of the extended time frame. I have not done so in the past because the firearm season was just too short for my schedule. This rule change is a good start in a positive direction for population control of both species of birds, however I think a more aggressive avenue should be taken to help the grouse.

Dennis Ogle, Westfield, IN (Email: June 24, 2010)
1. Too long for bow hunters. (May I suggest an economic study--a longer season in this economy will not raise revenues.) 2. Are there any ruffed grouse left? Close the season & start reintroduction!

"Exhibit C"

Department of Natural Resources Response

Proposed 2010 Fall Turkey Hunting Range
Dates for Archery and Firearm (shotgun) portions



North Firearm

Retains current 5-day format

10/20 to10/24

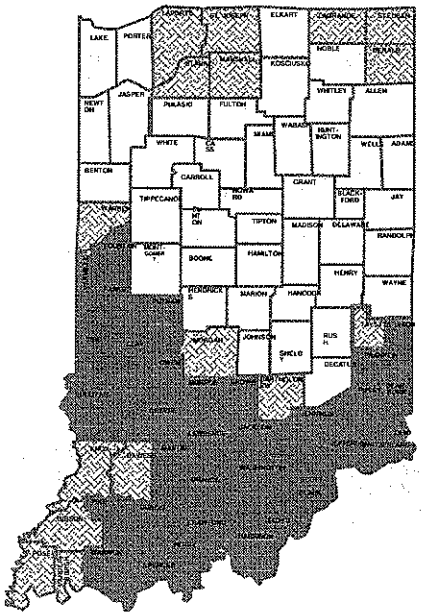
Archery (Statewide)

Two Separate Portions
(~ 60 days total)

10/1 to 10/31
12/4 to 1/2/2011

South Firearm
Extends current 5-day format to 12 days
10/20 to 10/31

Proposed New Fall Turkey Hunting Range



New Firearm Fall 2010

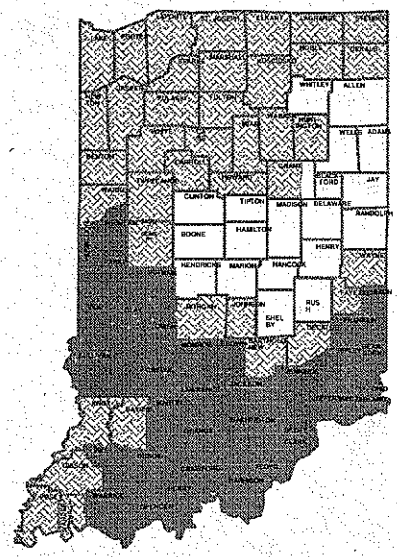
Adds 16 counties to Fall Firearms portion.
(7 north & 9 south)

Archery Statewide
Fall 2010

Expands Archery Statewide
from current 73 to all 92 counties

Current Firearm

Current Fall Turkey Hunting Range & Days of Opportunity



Fall Archery
~ 20 days

Spring Hunting Only

Both Archery & Gun
5 days

Fall Turkey Harvests

2005	2006	2007	2008
716	646	585	610

General Chronology of Harvests

20-25% During Archery only portion
75-80% 5-day combined Archery & Firearm (shotgun)
45-50% All weekends
35-40% Last weekend (combined archery and firearm)

Estimated Hunter Success

Archery Equipment < 2%
Firearms (shotguns) < 6%

Proportion of Fall to Spring Harvest

Statewide: Fall harvest total ≤ 7% of Spring harvest.
Theoretical Allowable: 50%

Harvest Permit Types

Majority (72%) taken by lifetime, youth, & exempt permitees.

Fall Turkey Seasons

Implemented in 2005

Conservative Season Structure

4- Year Evaluation Completed

Harvests and Hunter Participation low

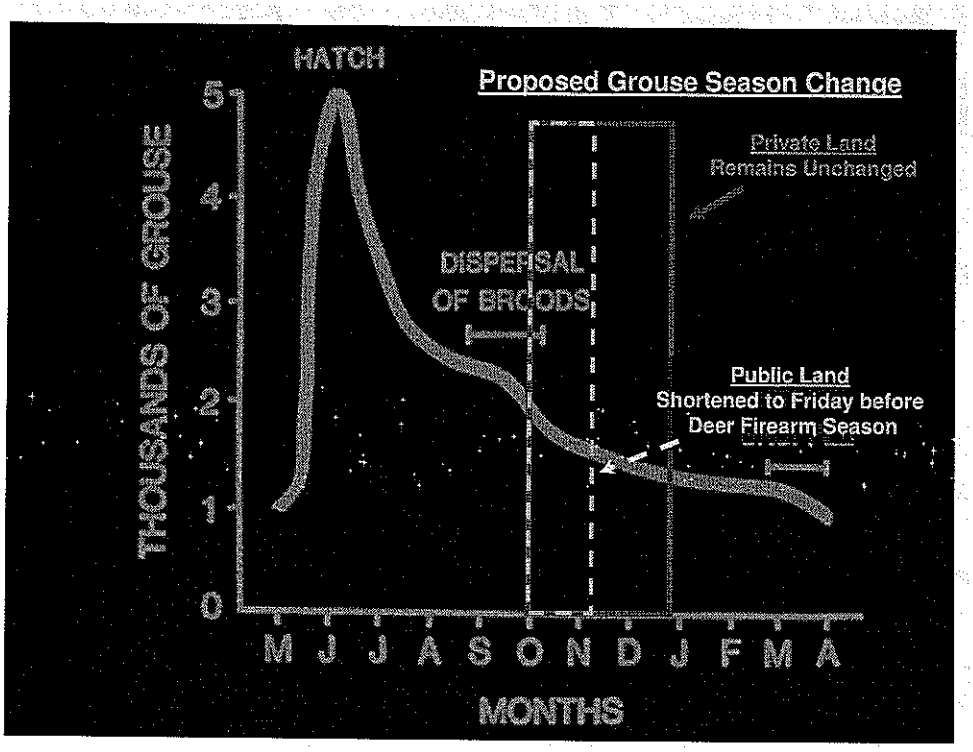
Relative Harvest Levels Low

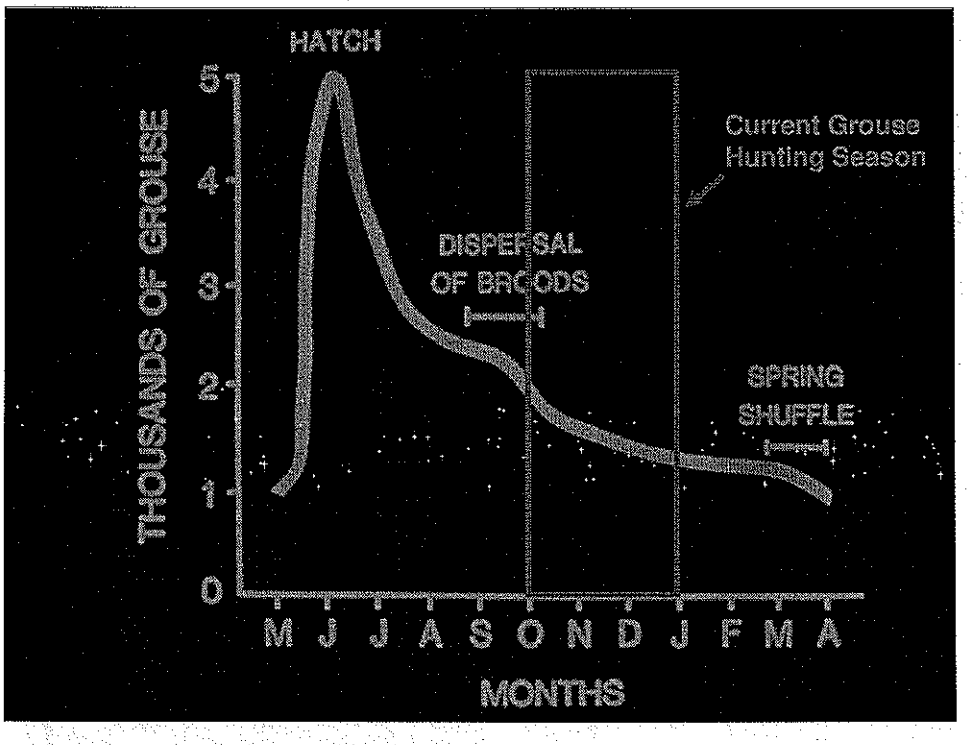
Hunter Success Low

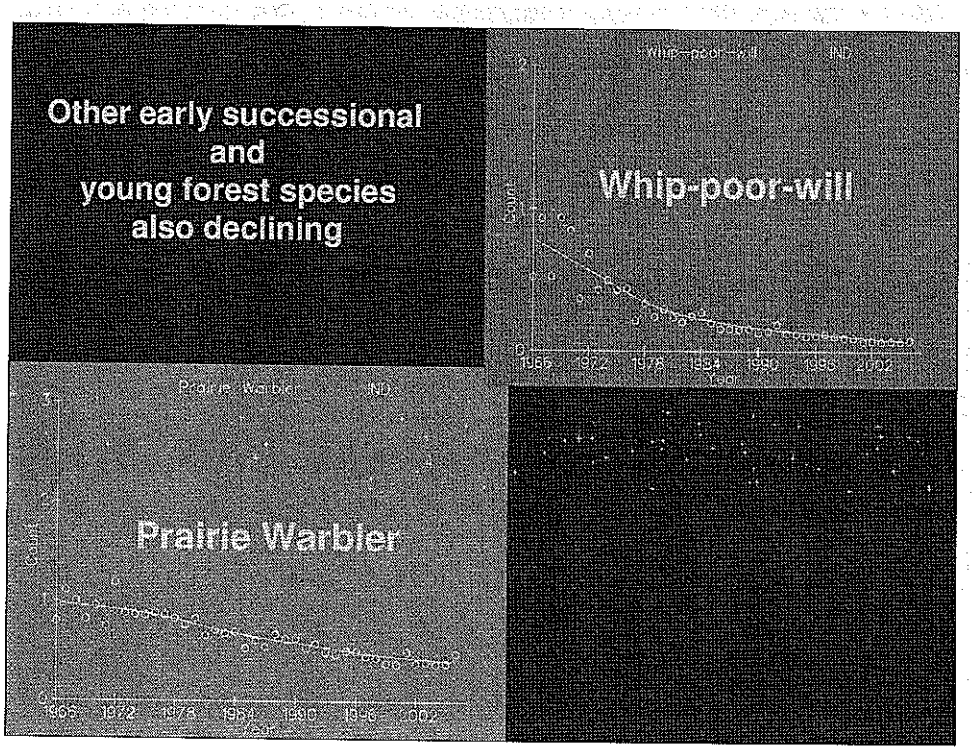
No impact on Spring Harvests

Room for Range Expansion

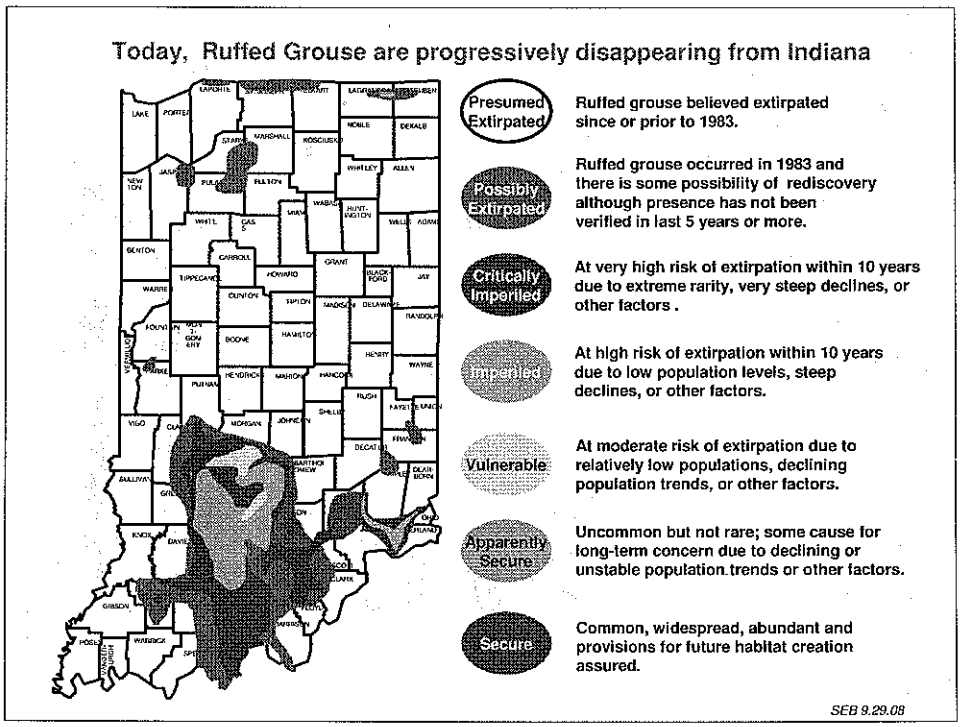
Room to Increase Days of Opportunity


Proposed Grouse Season Change
HATCH
Private Land
Remains Unchanged
DISPERSAL
OF BROODS
Public Land
Shortened to Friday before
Deer Firearm Season
THOUSANDS OF GROUSE
5
4
3
2
1
0
M J J A S O N D J F M A
MONTHS


HATCH
THOUSANDS OF GROUSE
5
4
3
2
1
0
Current Grouse Hunting Season
DISPERSAL OF BROODS
SPRING SHUFFLE
M J J A S O N D J F M A
MONTHS



Examples of other early successional or young forest birds undergoing declines are the whip-poor-will and the Prairie warbler. Both are migratory and that allows them to more easily colonize new habitats compared to the non migratory ruffed grouse. There are also a number of other birds, mammals, and invertebrate populations that are associated with early successional habitats that have declined too.



Today, ruffed grouse are likely extirpated from the northern 2/3rds of the state except for very restricted, critically imperiled populations in LaGrange County. Most existing populations in south central Indiana are considered imperiled. The best populations, listed as vulnerable, exist only where wind events in the last 10-15 years followed by salvage cutting created habitat. No secure populations are noted in green. Extirpation has occurred on the periphery of the 1983 distribution and it is highly probable that grouse have become extirpated from 15 counties since 1983. It is likely to exceed 25 counties within a few years if no major forest disturbance occurs.

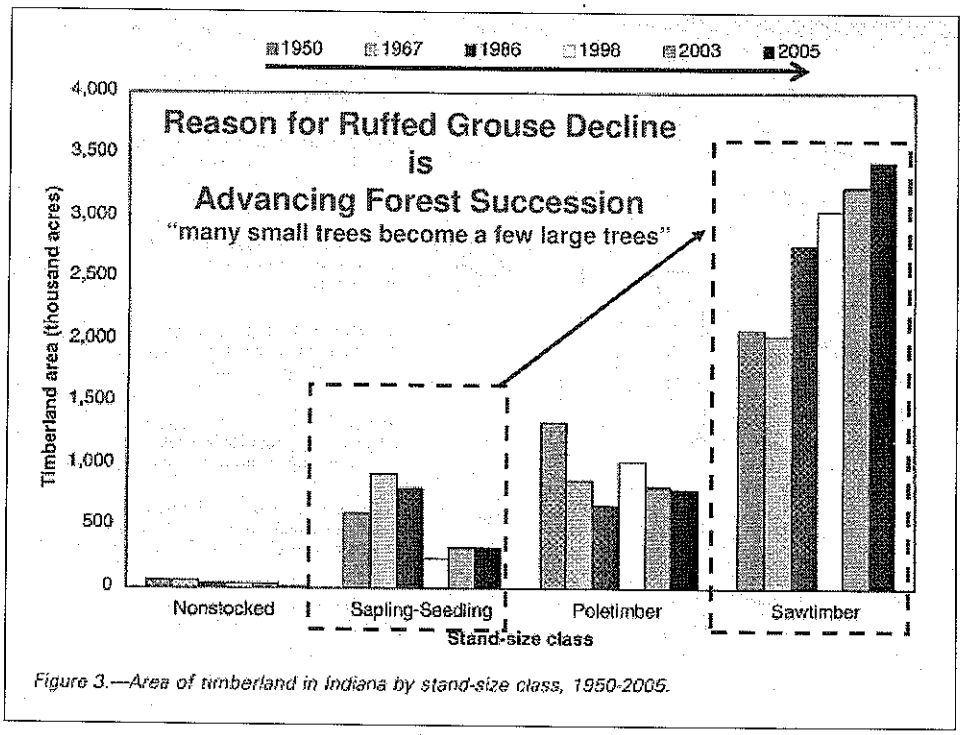
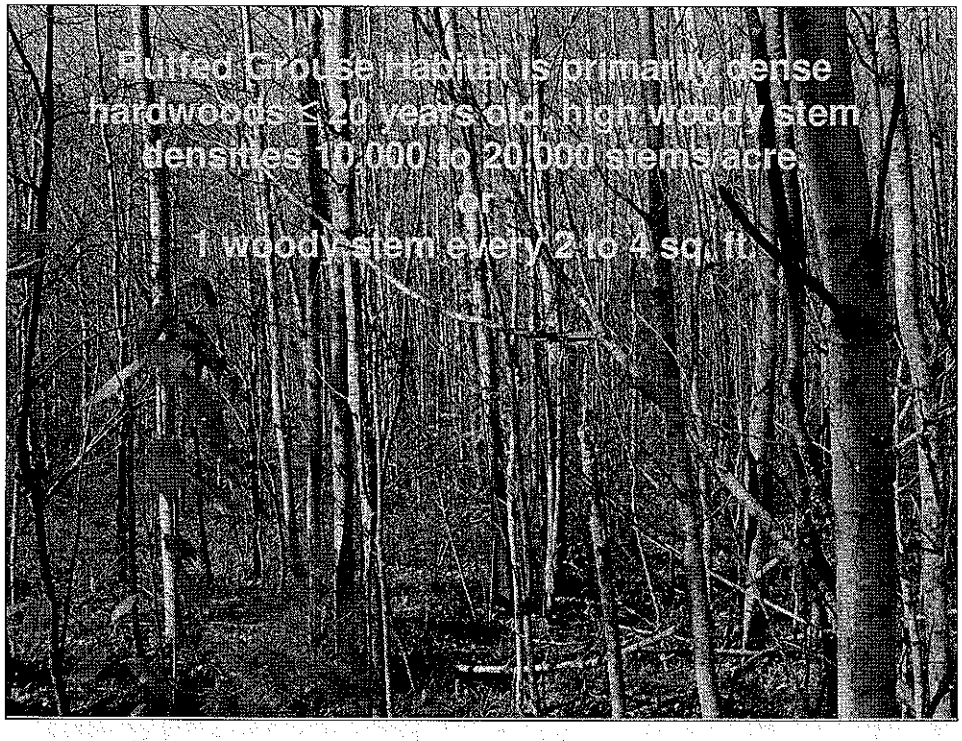


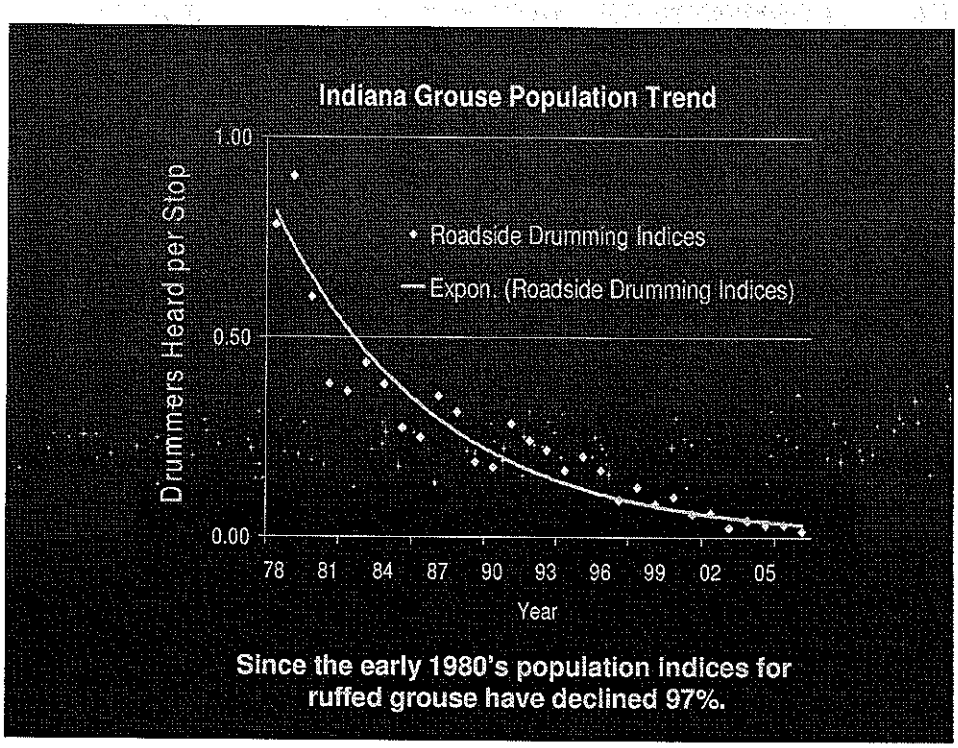
Figure 3.—Area of timberland in Indiana by stand-size class, 1950-2005.

Advancing Forest Succession is a process where "many small trees progressively develop into fewer large trees" of the more open mature forests.

Ruffed grouse populations have declined because of advancing forest succession that has shifted the composition of the forests to older age classes. Young hardwood forest habitats have decreased to a very small proportion of the forest cover over the last 35 years and this is directly related to the decline of ruffed grouse and other wildlife associated with early sucessional habitats.



Ruffed grouse are dependent on early succession or young forest habitats with high woody stem densities that follow some type of disturbance of either natural or human origin. When extensive forests covered most of Indiana, the combined natural forces of wind, fire, catastrophic flooding, and massive forest insect or tree disease outbreaks provided a consistent replenishing of young forest habitats across the forested landscape allowing ruffed grouse populations to shift with changing habitat conditions. In today's altered landscape of limited contiguous forest cover, ruffed grouse now primarily rely on man made forest disturbances or changing land-use.


Indiana Grouse Population Trend
1.00
0.50
0.00
Drummers Heard per Stop
Roadside Drumming Indices
Expon. (Roadside Drumming Indices)
78
81
84
87
90
93
96
99
02
05
Year
Since the early 1980's population indices for ruffed grouse have declined 97%.

Ruffed Grouse Hunting

- Grouse population levels dependent on "young forest" habitats.
- Grouse populations have declined 97% due to advancing forest succession.
- Habitat decline impacting other wildlife too.
- Proposal reduces potential impact on potential breeding stock.
- Retains incentive for habitat management on private lands.

- Continue or increase existing range-wide spring roadside drumming surveys and drumming activity center counts.
- Develop or re-implement "walking" surveys or drumming activity center counts in specific management areas to determine the relative degree of grouse population response.
- Potentially utilize volunteer observers to increase coverage on specific areas.
- Utilize information from other avian or wildlife monitoring surveys.

4) Develop and maintain young forest habitats across all public forest lands to assure needed ecological and habitat diversity for all wildlife species.
   - Create example demonstration areas of young forest habitats using vegetative disturbance techniques on all state properties where sufficient forest cover exists.
   - Focus effort on state properties in potential grouse range but young forest habitats should exist on all state properties.
   - Beyond possible timber harvest revenues, use of wood fiber should be used to demonstrate that it is a renewable natural resource.
   - Develop creative ways to show other benefits of creating early succession and young forest habitats (e.g., wood products for buildings/structures, firewood for fuel and to reduce spread of EAB, reduced property operating expenses, improved vistas).
   - Determine ways to remove or overcome administrative and Federal Aid barriers to timber harvesting/management on DFW lands.
   - Provide informative signage or kiosks near demonstration areas to inform and help educate the user groups and the public.

5) Encourage timber harvests on private lands.
   - Provide technical information and assistance.
   - Remove barriers, zoning restrictions, and limitations to timber harvests on private lands.
   - Develop or provide incentives for landowner cooperatives to facilitate timber harvesting across individual ownerships.
   - Pursue "use value assessment" type incentives for actively implementing timber management on classified forest lands.
   - Place emphasis on using silvicultural techniques that create dense regeneration.
   - Pursue efforts to develop better markets for low grade timber products.

6) The Game Bird Habitat Restoration Stamp Fund (GB) continues to be a point of discussion. There is the feeling that some of the funds need to be spent on the grouse program.
   - Instead of using game bird habitat funds for primarily land acquisition, funds should be used funding grouse studies/monitoring or other needs for grouse program. Some feel that Gamebird legislation needs to be changed to allow other uses.
   - Find ways to incorporate GB funds to enhance timber harvests that would improve positive impact on grouse populations on state lands.
   - Currently the legislation (IC 14-22-8-7) infers that the funds be used to compensate for habitat plan development for programs made available through various federal agencies. The legislation further states that the funds may be used to purchase land.

administrative, communications, and field staff. The early succession and young forest "ecological awareness" needs to transcend agency directors and Governor's administrations. More importantly, the message needs to come from what is perceived as non-vested, indirectly associated entities (e.g., academic and scientific communities, Audubon, Isaak Walton Leagues, Wildlife Federation, birding and nature appreciation groups). The public's improved acceptance of prescribed fire in recent decades is an example of what needs to be accomplished with creating and maintaining young forest habitats.

Actions Needed to Overcome Challenges

1.) Initiate a Department-wide communication and education effort through existing programs and conservation groups to improve the appreciation and acceptance ("ecological awareness") of creating and maintaining early succession and young forest habitats for a wide range of wildlife species. Periodic disturbance is a needed infusing restoring element of ecosystem dynamics.
   - Primary target audiences include agency staff, conservation groups, education community, legislative members, consulting foresters, woodland owner groups, timber groups, professional scientific organizations, SWCD's, NRCS district conservationists, cooperative extension services, and the public-a-large.
   - IDNR Outdoor education, interpretive naturalist, and private land (wildlife and forestry) programs would be key information disseminators.
   - Conservation groups (e.g., RGS, NWTF, IWF, etc) are integral partners not only in disseminating information but to provide supplemental support for young forest communication and education efforts (e.g., COVERTS, forest stewardship programs).
   - Promote the conservation and wise use of renewable forest resources over dependence on nonrenewable fossil resources.
   - Integrate provisions and recommendations of NA Conservation Plans as best possible for ruffed grouse, American woodcock and Landbird Habitat Conservation Strategy.

2) Create a ruffed grouse "core population area" where land management will include a focused effort to increase and maintain the endemic Appalachian subspecies (*Bonasa umbellus monticola*) for a possible source population should trap/transplant efforts be warranted; if unoccupied areas of suitable grouse habitat and sufficient size are identified in the future.
   - Determine the current distribution status of ruffed grouse.
   - Monroe, Morgan Brown, Jackson, Lawrence, Martin, and Orange counties provide the best opportunities in terms of existing populations, contiguous forest cover, and favorable micro-climate conditions.
   - Public forest lands include: Morgan- Monroe SF, Yellowwood SF, Jackson-Washington SF, Martin SF, Monroe Reservoir, and Brown County State Park.
   - Place emphasis on silvicultural techniques that create dense stands of hardwood regeneration that enhance grouse brood habitat.
   - Parameters and techniques for ruffed grouse restoration already exist. Suitable habitat of sufficient size and grouse populations of capable of sustaining trapping activity do not exist.
   - Reduce potential negative impacts to ruffed grouse breeding stock on public lands.

3) Expand or refine existing monitoring surveys of grouse populations to better assess response to habitat improvements and whether management efforts are adequate to improve grouse populations.

Sufficient suitable early successional and young forest habitats do not exist (1 or < 2% current estimate) to sustain ruffed grouse populations over the next decade at the current rate of decline, nor is suitable grouse habitat being created either naturally or man-induced at a rate to overcome the negative impacts of advancing forest succession on ruffed grouse populations. While the DoF has recently stepped up its timber harvesting with a goal of creating 10% in early successional habitat, current harvests rates only amount to half of its annual growth. Early successional and young forest habitats could be targeted with new acquisitions. HNF timber harvests have been stymied by never-ending appeals with no commercial hardwood timber sales in almost 25 years although there is apparently a renewed attempt to increase commercial hardwood harvests in a very limited area, albeit in a less physiographically favorable are of south-central Indiana. DFW has not managed its timber resources because of PR Federal Aid issues. Timber harvesting on private lands is not consistent due to ownership patterns (size and temporal) and is generally not intense enough to create sufficient hardwood regeneration for ruffed grouse.

Restoration of ruffed grouse through trap/transplant, even if suitable and adequate grouse populations existed, would be extremely costly and a fruitless effort doomed for failure if adequate habitat is not created first and a long term solution to advancing forest succession is not addressed. Recently cut-over or extensively disturbed areas (e.g., tornado) take at least 5 years post disturbance to come into grouse habitat and will only remain suitable grouse habitat 10-15 years thereafter depending on the site conditions. Under current administrative logistics, it takes 2-3 years of sale preparation on State lands to put a saw to wood; longer on Federal lands. While the majority of forest land is in private ownerships, the smaller ownership parcels often have quite varying ownership objectives that present another array of problems to create adequate amounts of young forest habitats even in the short term. Even under the best situations, there are limitations in the current timber markets to absorb a sudden surge of wood fiber from all sources. *Public acceptance of timber harvests however, is by far, the most overriding issue limiting opportunities to create and maintain young forest habitat.*

The public's lack of understanding that periodic disturbance plays a role in maintaining ecosystem diversity and integrity is a formidable obstacle to using man-induced tools to mimic natural disturbance events in a prescribed manner. The lack of young forest habitats is not just a problem for ruffed grouse but a consortium of animal and plant species not only in Indiana but across much of the eastern US. The public does not understand the resilient capabilities of renewable resources and that the central hardwoods region is one of the most resilient in North America. Declining ruffed grouse populations are just symptomatic of declining ecosystem diversity and the solution has to be addressed as an ecosystem management issue beyond individual species' needs. Disturbance is an integral part of ecosystem dynamics and natural disturbances no longer function to the degree they did historically in a landscape unaltered by humans.

Perhaps the most revolving theme of the summit meeting discussions was communication and education to develop a public appreciation of early succession and young forest types as part of maintaining ecological diversity. Public acceptance of man-induced disturbances is critical to allowing professional natural resource managers to use proven management tools, whether it be prescribed burning, timber harvesting, soil disturbance, or herbicide use. The demonstrated successful use of silvicultural techniques on public lands to create a diversity of habitat types and associated wildlife responses is also imperative if private forest owners are to even consider such habitat values and management practices in their land ownership objectives.

The "early succession and young forest" messages should be an integral part of every natural resource agencies' communications and outdoor education programs along with the efforts of <u>all</u> agencies

The Conservation of Ruffed Grouse in Indiana

Summary Report of Grouse Summit Meetings – 2008

Indianapolis, October 1, 2008

The first of four "Grouse Summit" meetings concerning the plight of ruffed grouse in Indiana was held May 30, 2008. The initial meeting brought together representatives of the conservation & hunting community specifically interested in ruffed grouse along with representatives from natural resource agencies to discuss mutual concerns about the severe 25 year decline in ruffed grouse populations due to advancing forest succession. Currently, ruffed grouse population levels are estimated to be < 4% of what they were 25 years ago and may be extirpated from portions of the known 1983 distribution in Indiana.

Ongoing and proposed actions to increase habitat and ruffed grouse populations were discussed. Given the complexities of those proposals and actions, the group decided a smaller subcommittee composed of selected sportsmen, natural resource specialists and natural resources agency administrators should meet to "flesh out" the details of the proposals and agree upon actions to improve populations of ruffed grouse. The findings of the "grouse summit" meetings were to be presented as a summary report to the original group and other interested parties. The subcommittee met 3 times over the summer to reach some type of consensus to best accomplish the needed actions. Attendees at 1 or more of the meetings included:

Mr. Pete Hanebutt, Grouse Hunter, RGS member.
Mr. Jack Corpuz, Grouse Hunter, FWCC representative, RGS member.
Mr. Wayne Bivans, Chief of Wildlife, DFW, IDNR
Mr. Mitch Marcus, Staff Specialist/Research Supervisor, DFW, IDNR
Mr. Phil Bloom, Director of Communications, IDNR
Ms. Judi Perez, Acting District Ranger, HNF, USFS
Mr. Scott Haulton, Forest Wildlife Biologist, Division of Forestry (DoF), IDNR
Mr. Steve Backs, Ruffed Grouse Biologist, DFW, IDNR

Primary Expectations of Summit Meetings

1) Maximize habitat enhancement programs and opportunities to improve ruffed grouse populations.
2) Develop a public appreciation and desire for early succession forests.

Challenges Identified during Subcommittee Meetings

Suitable habitat for ruffed grouse exists primarily in hardwood stands ≤ 20 years with 30% of the forest in early succession or young forest types stands across a landscape on a scale of townships to sustain a viable grouse population. Ideally, the suitable habitat areas should be in close proximity (¼ to ½ mi) to better assure successful grouse dispersal and colonization. Cuttings 15-20 acres are the most cost effective from a silvicultural standpoint and for ruffed grouse on larger and public ownerships in Indiana, especially where oak regeneration is an important objective. Where habitat for ruffed grouse is the primary management objective, preferred grouse habitat would be created by an equivalent acreage of smaller 5-10 acre cuts. The smaller cuts would also be more applicable to generally smaller, private ownerships.

affect the value of these habitats for ruffed grouse. Populations of browsing animals need to be maintained within levels that do not adversely affect these habitats.

Basic data on ruffed grouse populations are unavailable in many regions. Few states or provinces collect information on ruffed grouse populations, harvest or hunter numbers. This lack of data can expose ruffed grouse habitat and population management efforts to public and legal challenge. In those states and provinces where the ruffed grouse is an important game species or is of concern due to low numbers, resource management agencies should attempt to fill in the most glaring of these knowledge gaps.

Acknowledgements

We are indebted to the authors of the Plan's 14 chapters and to the many other natural resource professionals who assisted this effort by providing data or reviewing draft versions of the Plan.

Financial support to offset costs associated with the development and delivery of the Ruffed Grouse Conservation Plan was provided by the National Fish and Wildlife Foundation, R. K. Mellon Family Foundation, Ruffed Grouse Society and the Wildlife Management Institute.

Hunters contribute to the economy.

Access the Ruffed Grouse Conservation Plan

The Ruffed Grouse Conservation Plan, in its entirety, may be viewed at: http://www.ruffedgrousesociety.org

Within BCRs where ruffed grouse populations have declined since 1980, returning populations to the 1980 levels will require an increase in the amount of young-forest habitat from what exists today. In most instances, this will require an increase in the use of even-age forest management practices on both public and private forests lands. BCR-, state- and province-level recommendations for returning ruffed grouse populations to or sustaining these populations at 1980 levels are provided in the Plan.

small patch cuts are popular with private landowners

Throughout much of the range of ruffed grouse, large blocks of forest are being fragmented into smaller parcels due to suburban sprawl, housing developments and other land-use changes. In addition, the number of privately owned forest tracts is increasing as large, single-owner holdings are being divided into smaller parcels. Private individuals that own relatively small tracts of forest are less likely to manage their forests to establish young-forest habitats than are owners of large tracts. Both of these trends can reduce the likelihood that ruffed grouse habitat management will occur in the future.

Increasingly, forest management policies restrict the types of management that can occur along stream corridors and near other wetlands. Without question, forested areas adjacent to waterways warrant special consideration to ensure that water quality isn't degraded. But, young-forest habitats in these areas can be especially productive for ruffed grouse in some regions, as well as for other species, especially American woodcock. Inflexible policies regarding habitat development in these special areas complicate efforts to conserve ruffed grouse and other wildlife that require young-forest habitats.

woodcock hen and and chick

Browsing by cattle, white-tailed deer, moose and elk can significantly reduce the density of trees and shrubs in young-forest habitats. This reduction in tree and shrub density can negatively

Because land management policy can be strongly influenced by public sentiment, it is imperative that the general public gain a better understanding of the value of young-forest habitats and of the ecological role of sustainable forest management in forest conservation.

forests have increased during this same period. In 2007, the American Bird Conservancy identified young, deciduous, forest habitats in the eastern United States as one of the nation's 20 most threatened types of habitat for birds.

The decline of ruffed grouse populations may cause declines in the number of ruffed grouse hunters. In those states and provinces that track the number of ruffed grouse hunters, declines are evident since 1990 (Figure 4). These declines are consistent with U.S. Fish and Wildlife Service surveys that document a 50-percent decline in the number of small-game hunters in the United States between 1985 and 2001.

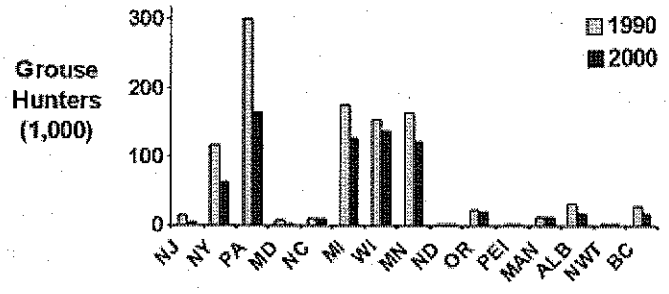
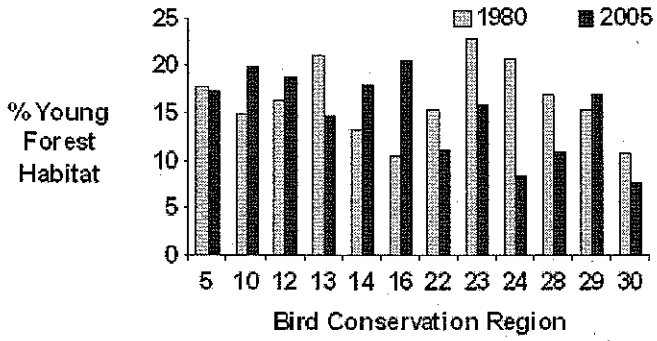


Figure 4. Trends in the number of ruffed grouse hunters from states and provinces with available data.

Returning Ruffed Grouse Populations to 1980 Levels

Although research from across North America has demonstrated that ruffed grouse have the opportunity to be numerous on landscapes that support abundant young forest habitat, there are additional challenges affecting the future of ruffed grouse management. There is widespread misunderstanding that old forests are inherently more important for wildlife than young-forests. Because land management policy can be strongly influenced by public sentiment, it is imperative that the general public gain a better understanding of the value of young-forest habitats and of the ecological role of sustainable forest management in forest conservation.

Figure 2. A comparison of the amount, in percent, of young-forest habitat (i.e., that is less than or equal to 20 years old), in 1980 and 2005, within those BCRs where 1980 forest inventory data are available.



Habitat Changes Affect More Than Just Ruffed Grouse

The same young-forest and shrub-dominated habitats preferred by ruffed grouse are preferred by numerous other species of wildlife, such as the American woodcock, golden-winged warbler, New England cottontail, blue-winged warbler, MacGillivray's warbler and the white-crowned sparrow. Some of the species that prefer young-forest habitats are experiencing precipitous population declines. Indeed, within the eastern portions of the United States and Canada, 53 percent of the bird species that breed in shrub-dominated or young-forest habitats have declined since 1980. Whereas, 36 percent of the bird species that breed in mature forests have declined during this same period (Figure 3). Conversely, only 14 percent of the bird species that breed in shrub-dominated or young-forest habitats have increased since 1980; whereas, 34 percent of the bird species that breed in mature

Figure 3. The proportion of species that is increasing, decreasing and stable, for bird species that breed in shrub-dominated and young-forest habitats, and for bird species that breed in mature forest habitats in the eastern portions of the United States and Canada (1980–2005).

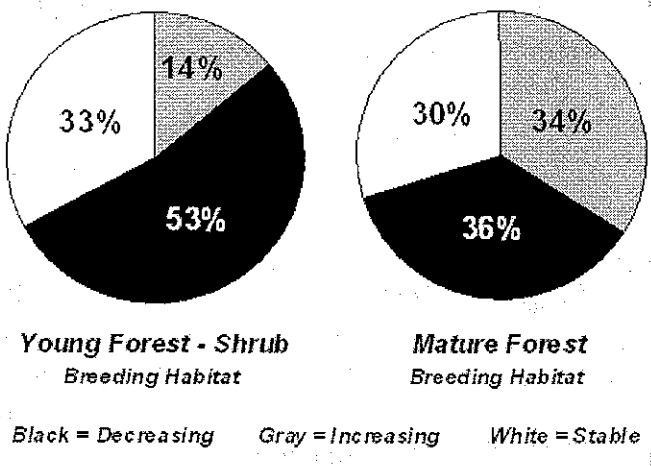
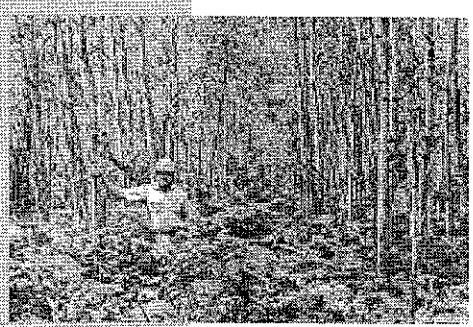


Table 1. Historical and current estimates of ruffed grouse breeding population density by Bird Conservation Region.

Bird Conservation Region	1980 Ruffed Grouse Density[1]	2005 Ruffed Grouse Density	Trend[2]
4–Boreal Forest	na[3]	na	
5–Northern Pacific Rainforest	0.19	0.28	47
6–Boreal Taiga Plains	na	14.1	
8–Boreal Softwood Shield Forest	na	10.3	
10–Northern Rockies	0.06	0.11	83
12–Boreal Hardwood Transition	12.8	12.8	0
13–Lower Great Lakes/ St. Lawrence Plain	9.5	9.1	-4
14–Atlantic Northern Forest	9.1	9.8	9
16–Southern Rockies Colorado Plateau	0.5	0.8	60
22–Eastern Tallgrass Prairie	4.3	3.2	-26
23–Prairie Hardwood Transition	10.9	9.6	-12
24–Central Hardwood Forest	1.9	1.7	-10
28–Appalachian Mountains	5.3	5.0	-6
29–Piedmont	1.9	1.9	0
30–New England/Mid-Atlantic Coast	6.6	6.3	-5

[1] drumming, male grouse per square mile (2.6 km^2)
[2] data given in percent
[3] comprehensive data for entire BCR are unavailable

Because of the manner in which these population estimates were derived, it is probable the Plan's population density estimates for western BCRs (e.g., BCRs 5 and 10) underestimate actual ruffed grouse population densities. Likewise, ruffed grouse populations were probably overestimated for those eastern BCRs where large blocks of forest are uncommon and are becoming even more so (e.g., BCRs 22, 23 and 24). The authors of individual BCR chapters (found on-line in the Ruffed Grouse Conservation Plan) were encouraged to use their expertise and that of other resource professionals from the region, to determine the most accurate ruffed grouse population estimate.

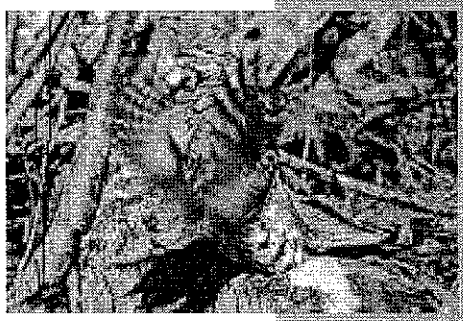


young aspen forest provides quality grouse habitat

Because ruffed grouse populations are so strongly tied to young-forest habitats, it's not surprising that ruffed grouse populations have declined since 1980 in those BCRs where young-forest habitats have declined. It also is not surprising that populations have increased in those BCRs where these important habitats have increased. The amount of young-forest habitat in each BCR is shown in Figure 2.

are divided into 37 different BCRs; ruffed grouse are found in 17 of these. A map showing the BCRs in the United States and Canada may be viewed at http://www.nabci-us.org/bcrs.html.

The year 1980 was used as the base year for comparison because it represents a point in time when ruffed grouse habitats and populations were probably at "normal" levels, at least for the recent past, and because data documenting the types and ages of forests were available for most portions of the ruffed grouse range. For some BCRs, however, forest composition data weren't available for 1980, making it impossible to estimate trends in ruffed grouse habitat availability and population size.



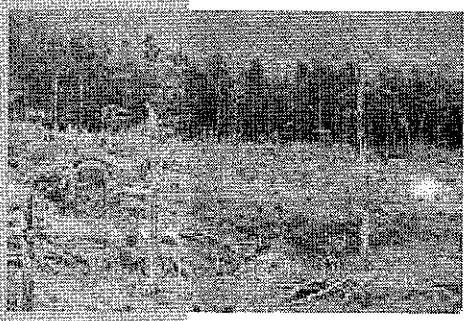
ruffed grouse drumming in spring to attract females

Only a few states and provinces annually collect data on ruffed grouse populations—through drumming surveys, hunter flush counts or some other means—so definitive population data were quite limited. Data from the Breeding Bird Survey, which is coordinated annually by the U.S. Fish and Wildlife Service and the Canadian Wildlife Service, were not used because these surveys are typically conducted long after the peak of ruffed grouse drumming each spring and do not provide an accurate measure of local ruffed grouse populations. Therefore, estimates of the ruffed grouse population and of the population density for each BCR were based on the types and ages of forests within each BCR.

What the Ruffed Grouse Conservation Plan Tells Us

Ruffed grouse population densities, represented by the number of drumming males per square mile where estimates are available, have declined in most eastern BCRs and have increased in western BCRs (Table 1). Within those regions where ruffed grouse population data are available from state or provincial resource management agencies, data were consistent with the habitat-based population estimates developed for the Plan.

Development of the Ruffed Grouse Conservation Plan



recent clearcut in the central Appalachians

The same young-forest and shrub-dominated habitats preferred by ruffed grouse are preferred by various other wildlife species of conservation concern. For example, in the northeastern United States, state wildlife action plans collectively identify 58 species in great conservation need that are dependent upon young-forest and shrubland habitats similar to those preferred by ruffed grouse. Ten of these 58 species are state listed as endangered in 1 or more states, 4 species are state listed as threatened in 1 or more states and 17 species are state listed as a species of special concern in 1 or more states. These 58 species include 37 birds, 14 mammals and 7 reptiles.

Due, in part, to the recent declines in young-forest habitats in some regions and to recent declines of ruffed grouse and other wildlife that use these habitats, in 2003, the Resident Game Bird Working Group of the Association of Fish and Wildlife Agencies endorsed the development of the Plan. The Plan was completed in 2006.

The objectives of the Plan are two-fold:

1. to compare ruffed grouse habitat conditions and populations between the base year (1980) and 2005
2. to identify the habitat management objectives required to sustain populations at or to restore them to the 1980 levels.

The Plan utilizes bird conservation regions (BCRs) as the landscape units used to compare historical and current levels of ruffed grouse habitats and populations. BCRs are geographic areas that contain similar patterns of landforms and vegetation and, hence, support similar environmental conditions for birds. The concept of using BCRs for bird conservation efforts is well supported by the scientific community. The continental United States and Canada

Aspen forests can support many more ruffed grouse than other types of forest. Young aspen forests provide excellent year-round habitat for ruffed grouse, especially since the flower bud found on mature male aspen trees is an important source of winter food. Indeed, the aspen forests of the Great Lakes Region can be considered the very heart of the ruffed grouse range.

Ruffed grouse are abundant only where young forests, those from 5 to 20 years of age, are common. These young-forest habitats typically support 5,000 to 8,000 trees and shrubs per acre and provide ruffed grouse with excellent protection from hawks, owls and other predators.

ruffed grouse feeding on aspen buds

Historically, young-forest habitats were sustained throughout the ruffed grouse range primarily by fires caused by lightning or by Native Americans. Today, in most regions, mature timber must be cut at regular intervals (every 10 to 15 years) to provide a mosaic of forest habitats of various ages and a continuous supply of quality ruffed grouse habitat. Frequently, grouse habitat management is best accomplished through sustainable forest management.

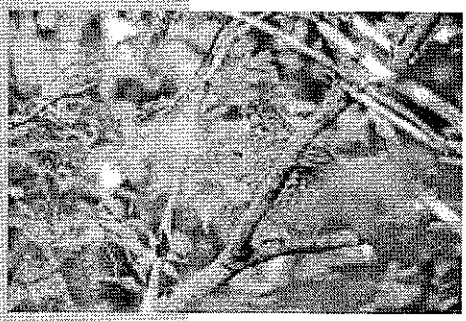
Sustainable forestry practices that remove all or most of the trees at one time from an area of 3 acres (1.2 ha) or more are the best tools to establish and sustain quality ruffed grouse habitat. These practices are phrased *even-age management* because they result in a forest stand where all of the trees are nearly the same age. By removing all or most of the forest canopy at one time, a thick, young-forest habitat—ideal for ruffed grouse—develops. Unfortunately, because this type of habitat management can be visually dramatic, it is often both poorly understood and poorly accepted by some within the general public. The visual impacts of these types of habitat management practices can be mitigated by altering the size and shape of the harvest units and by retaining small patches of standing trees within the units.

Today, in most regions, mature timber must be cut at regular intervals (every 10 to 15 years) to provide a mosaic of forest habitats of various ages and a continuous supply of quality ruffed grouse habitat.

grouse hunters from rural community

throughout much of the eastern United States and Canada. Approximately 1,000,000 hunters harvest between 2.2 and 2.8 million ruffed grouse throughout North America during a year; ruffed grouse hunters contribute over $500 million to local economies each year.

Ruffed grouse populations exhibit a 10-year cycle throughout the northern portion of the bird's range. Local populations will increase for 4 to 5 years, eventually becoming quite numerous. The population peak will then be followed by 4 to 5 years of steady decline until the birds become relatively scarce. Then, the cycle begins again. Populations south of the northern tier of the United States exist at relatively low population densities and do not consistently exhibit detectable 10-year population cycles. Both the number of ruffed grouse hunters and the number of ruffed grouse harvested increase during years when populations are at or near the peak of the cycle (Figure 1). Ruffed grouse are numerous only in regions with extensive forests. Although ruffed grouse can be found in many different types of forest, deciduous forests, such as aspen, birch, maple or oak, are preferred.



ruffed grouse in maple tree

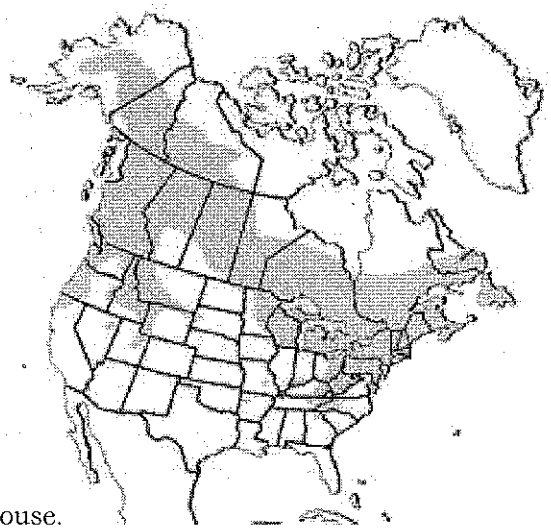
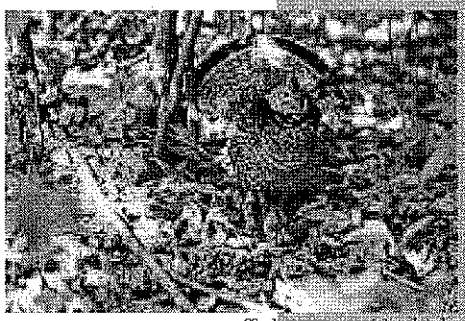


Figure 1. Range of the ruffed grouse.

Summary

The purpose of this report is to introduce the Ruffed Grouse Conservation Plan (Plan), an analysis, a discussion and recommendations published for the well being of ruffed grouse, North America's most widely distributed grouse species. It is of significant social and economic value as a game bird in some regions.

Ruffed grouse populations generally have declined since 1980 throughout much of the eastern United States where their popularity as a game species is greatest. Ruffed grouse populations in the western United States and Canada have probably increased as a result of recent large-scale wildfires.



ruffed grouse with chicks

Population declines of ruffed grouse and of other wildlife species that require thick, young forest habitats can only be stemmed or reversed by increasing the abundance of these habitats through the use of sustainable forest management. The negative public attitude toward this type of habitat management is the single greatest challenge faced by natural resource managers when proposing to manage forestland for ruffed grouse and for numerous other species of wildlife that prefer similar habitats. State, provincial, federal and tribal resource management agencies, nongovernmental organizations, and others interested in wildlife conservation must redouble their efforts to increase public understanding and acceptance of forest management practices that are capable of sustaining young-forest habitats and associated wildlife. Failure to do so will hamper efforts to conserve the full array of forest biodiversity and will threaten the future of North America's hunting heritage.

Efforts must be redoubled to increase public understanding and acceptance of forest management practices that are capable of sustaining young forest habitats and associated wildlife.

Ruffed Grouse Ecology and Management

The ruffed grouse is North America's most widely distributed grouse species and is the most popular resident game bird

For more information on the information presented
in this booklet, contact

Association of Fish and Wildlife Agencies
444 North Capitol Street, NW, Suite 725
Washington, DC 20001
(202) 624-7890
http://www.fishwildlife.org

Ruffed Grouse Society
451 McCormick Road
Coraopolis, PA 15108
(412) 262-4044
http://www.ruffedgrousesociety.org

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compiled by:
Resident Game Bird Working Group
of the Association of Fish and Wildlife Agencies

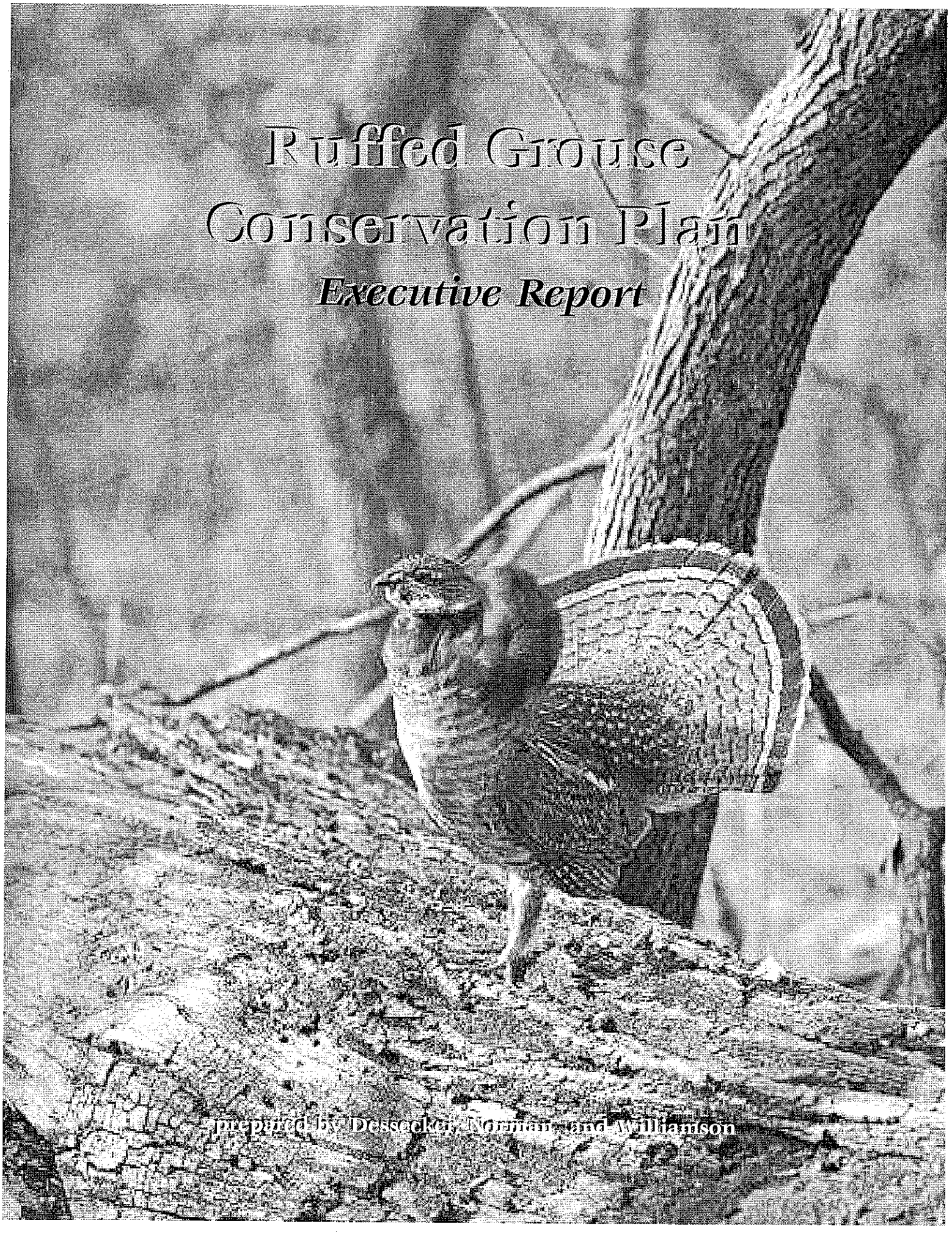
copyediting and design by: J. Rahm, Wildlife Management Institute

Ruffed Grouse Conservation Plan

Executive Report

prepared by:
Daniel R. Dessecker, *Ruffed Grouse Society*
Gary W. Norman, *Virginia Department of Game and Inland Fisheries*
Scot J. Williamson, *Wildlife Management Institute*

August 2007



Ruffed Grouse Conservation Plan

Executive Report

prepared by Dessecker, Norman and Williamson

Figure 7. Percent Forest Cover by County

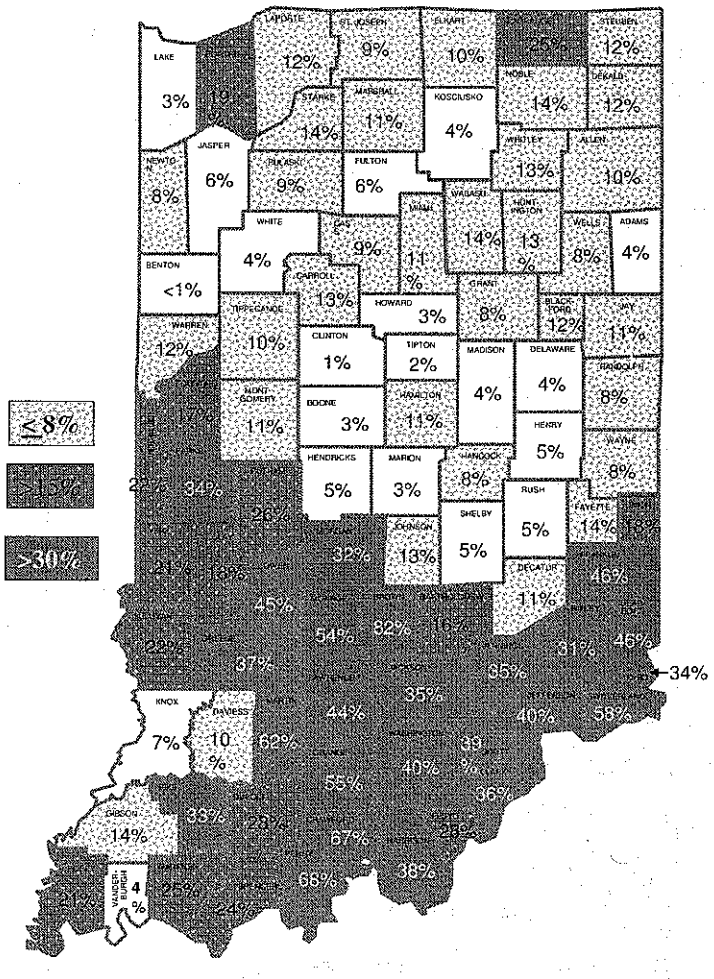


Figure 6.
Mean 2008 and 2009 Spring Turkey Harvests

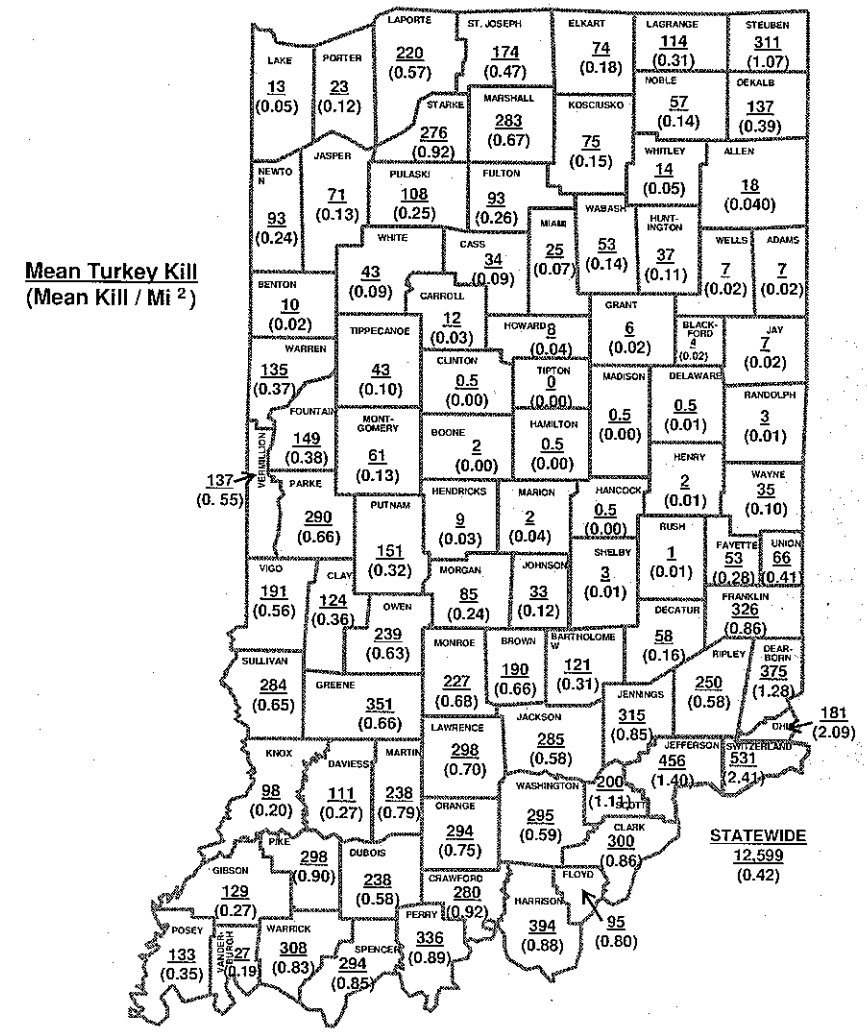


Table 2. Indiana Fall Wild Turkey Season Summary 2005 to 2008

	YEAR				
	2005	2006	2007	2008 *	Means
Harvests					
Annual Harvest	716	646	585	610	**639**
Statewide Fall/Spring Ratio in %	6%	5%	5%	5%	**5%**
County F:S Ratios (range of values)	0-15%	0-17%	0-18%	0-11%	**0-18%**
(Note: high side related to low kill spring counties with archery only hunting, e.g., 1 fall/6 spring)					
Chronology of Harvest					
Archery Only	19%	26%	26%	22%	**23%**
Combined Archery/Gun	81%	74%	74%	78%	**77%**
All Weekends	50%	50%	46%	44%	**47%**
Last Weekend (Bow/Gun)	40%	37%	36%	38%	**38%**
Weapon Harvest					
Archery	24%	36%	35%	28%	**31%**
Crossbow	2%	2%	2%	4%	3%
Shotgun (includes muzzleloader SG's)	73%	62%	64%	67%	**67%**
Age Structure					
Juvenile:Adult	1:3	1:4	1:3	1:3	**1:3+**
% Adults both Sex	79%	74%	73%	75%	**75%**
Adult Gobblers %	40%	32%	31%	28%	**33%**
Juvenile Gobblers %	12%	9%	18%	8%	12%
Gobblers %	51%	40%	49%	36%	44%
Adult Hens %	34%	48%	42%	47%	43%
Juvenile Hens %	15%	12%	9%	17%	13%
Hens %	49%	60%	51%	64%	56%
Harvest by Permit					
Resident Fall	22.0%	23.0%	22.0%	23.0%	**23%**
No. Resident Fall Licenses Sold	2,225	1,682	1,557	1,689	**1,788**
Non-Resident Fall	0%	0%	1%	1%	1%
NR Licenses Sold	20	2	8	13	11
Comp. Lifetime	62.0%	53.0%	49.0%	48.0%	**53%**
Potential Lifetimers	43,028	43,028	43,028	43,028	43,028
Youth	5%	7%	9%	12%	**8%**
Youth Lic. Sold	19,195	22,947	23,674	37,192	25,752
Landowner	11.0%	10.0%	9.0%	12.0%	**11%**
Total No Additional Annual permit	78.0%	70.0%	67.0%	72.0%	**72%**
Est. Hunter Participation & Success	(2006 fall participation estimated from 2007 Spring Hntr ?re.)				
No. Hunters during Archery Only		10,168			
No. Hunters Hunting Bow/Gun Portion		8,523			
Estimated Arcehry Success		**1.7%**			
Estimated Firearm Success		**5.6%**			

* Gun range expanded to westcentral Indiana in 2008.

Fig. 3. Fall Harvests

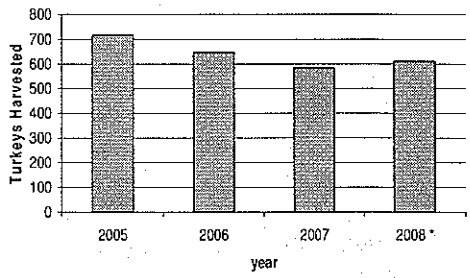


Fig 2. Resident Fall WT Licenses Sold

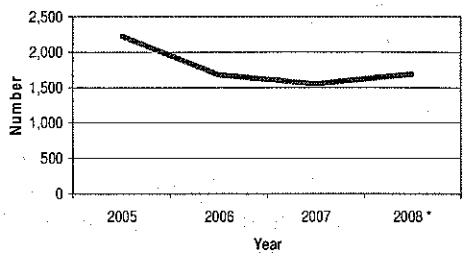
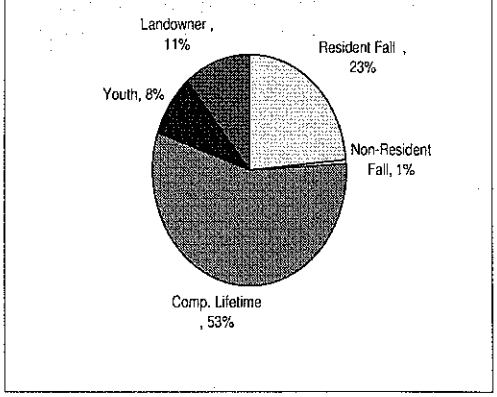


Fig. 4. Harvest by Permit Type



population management tool, especially where adverse conditioning is needed to reduce human acclimation associated with "nuisance" turkey complaints.

Conflicts with deer season

The fall wild turkey season currently runs from October 1-25 for archery equipment and October 21-25 for firearms. There are already other seasons in place for hunting rabbits (on designated state properties), squirrels, ruffed grouse, coyotes, and foxes in October. The hunting seasons for game birds such as pheasants and quail also take place early November and December. The DNR believes that a number of those who hunt other species such as deer will also hunt wild turkeys while they are out in the field.

Concerns about populations in Hancock and Rush counties

The agency has taken a very conservative approach to setting up the fall turkey season. According to harvest records, the taking of toms and hens during Indiana's fall turkey season has not been a detriment to the turkey population. The 2009 spring harvest was the second highest in 40 years. Statewide our fall to spring harvest ratio is around 5%. This is ten times lower than the theoretical maximum fall to spring harvest ratio based on harvest/population modeling research. In addition, landowners and hunters in east central Indiana counties are interested in the growth of the turkey population in that area as evident in correspondence the agency has received. Due to this landowner/hunter interest, potential fall hen harvest is limited.

Hunter Orange Requirement

The DNR has historically required all hunters that hunt in any season that overlaps with the rabbit, pheasant, quail and deer firearms and muzzleloaders seasons to wear hunter orange. Hunter orange is necessary to provide for the safety of all hunters while in the field.

Based on 2007 turkey hunter questionnaire, approximately 15,000 hunters participated in the 2006 fall turkey season; 68% hunting during the archery only portion (14-19 days) and 57% hunting the 5-day combined archery/shotgun portion. Lifetime licensees accounted for 58% of the fall turkey hunters, resident fall turkey licensees 22%, youth 10%, exempt landowner/military 9%, and non-residents < 0.5%. The estimated archery hunter success was 1.7% (Table 2) and falls in line with the general ≤ 3% reported by other states. The estimated shotgun hunter success was 5.6% which is lower than the 15-20% reported by other states, but was likely influenced by the short 5-day firearm's portion and general lack of Indiana hunter experience with fall hunting techniques.

The proposed changes to the fall turkey season structure were developed using 4-year assessment of turkey hunting under the current fall season structure, examination of the relative turkey population levels in each county based on the two subsequent spring harvests (Figure 6), the proportion and distribution of forest cover in each county (Figure 7), and proximity to other counties with similar parameter levels.

The relatively low harvests, hunter participation, and hunter success under the current conservative fall season structure indicated that the hunting range and the days of hunting opportunity could be expanded for both archery and firearms (shotgun) portions of the season. Even if hunter participation, hunter success, and resulting harvests were all to double, the estimated fall:spring harvest ratio (10%) would still remain considerably below the theoretical maximum and would be sustainable even with less than good production levels. The proposed fall turkey structure would still be considered conservative relative to other surrounding states and still demonstrates the department's commitment to emphasize spring over fall hunting opportunities as desired by turkey hunters in general.

The extension of the archery hunting opportunities will likely have a negligible effect on overall fall harvests levels given the relatively low archery hunter success (≤ 2%). The increase in the firearm portion to 12 days in the south (includes 2 weekends) will be more attractive to hunter participation, will likely increase shotgun hunter success and fall harvest levels, but those increases should not reach appreciable levels to have negative impacts on wild turkey populations or subsequent spring hunting success. The more conservative 5-day firearms season in the north for a few selected counties will allow for a 3-year assessment of fall firearm hunting in a region with relatively lower overall turkey population levels, less forest cover, and relatively "younger" but still growing turkey populations.

Affect on spring hunting season

The assessment of the 2005-2008 fall harvests demonstrated that subsequent spring harvests were not negatively impacted despite below average production, and that the current conservative fall season structure is well below the theoretical maximum levels to sustain turkey populations and spring hunting success. Concerns about limited fall harvests fail to consider limitations of habitat carrying capacity and natural, self-regulating mechanisms influencing turkey populations irrespective of hunting mortality. The failure to implement fall turkey hunting will unnecessarily deny hunters available recreation opportunities to utilize a renewable natural resource. Fall either sex turkey hunting also provides wildlife managers with a potential

The proposed changes are intended to increase fall turkey hunter opportunities that are sustainable without long term negative impacts on the turkey resource or subsequent spring hunting success. The fall bag limit will remain unchanged at one wild turkey of either sex per hunter per fall.

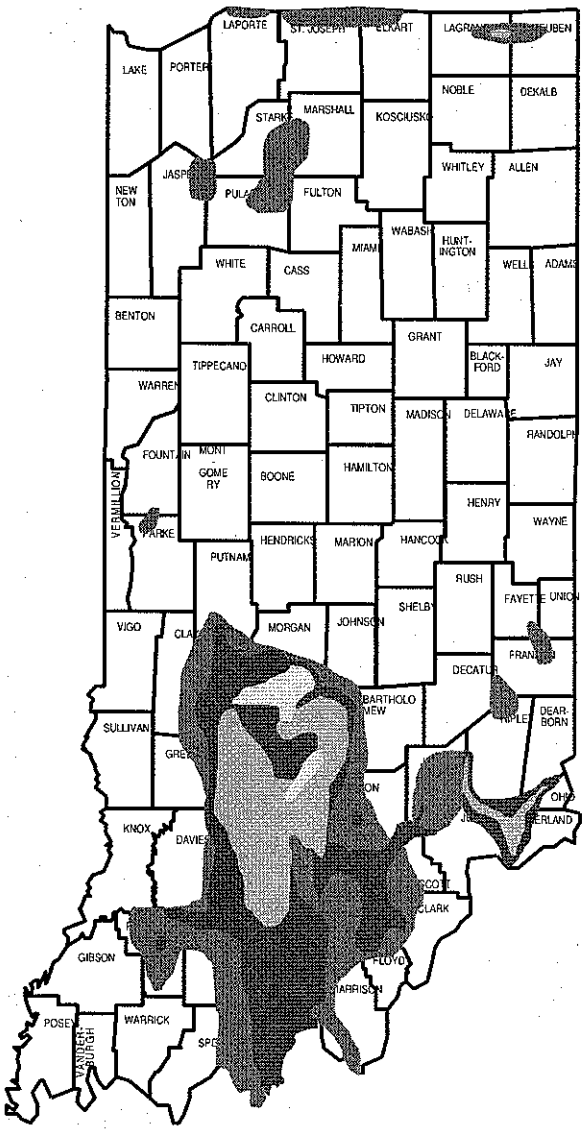
Background Information

The original assessment of fall turkey options for Indiana was used for developing and implementing the 2005 fall turkey season in Indiana. A very conservative harvest strategy was adopted using criteria pertaining to percent forest cover, restoration status, spring harvest history/levels, and individual county proximity to other counties meeting the criteria. Additional restrictions were regulations limiting the bag limit to one bird either sex, and season length, and equipment used (archery or shotgun). One objective of implementing a conservative harvest approach was to conduct a 3-5 year assessment of fall harvests, potential impacts on subsequent spring harvests, hunter participation, and relative hunter success under our licensing structure while monitoring trends in wild turkey population indices.

Harvests results for the 2005 to 2008 fall turkey seasons were summarized by hunting equipment used, portion of the season (archery/firearms), day of the season, permit type, sex and age structure, and individual county harvests. Fall hunting participation by permit type, portion of season hunted, and hunter success were estimated for the 2006 fall season through the 2007 turkey hunter questionnaire. Copies of the harvest reports can be accessed at http://www.in.gov/dnr/fishwild/3352.htm . A summation of the 2005-2008 harvests with 4-season mean values is presented in Table 2.

As expected, fall harvests were relatively low and hunter participation declined after the initial implementation, with a slight increase related to expansion of the fall hunting range in 2008 (e.g., resident fall permit trends). The proportion of the fall to spring harvest was consistently around 5% statewide, ten times lower than the theoretical maximum 50% ratio based on harvest/population simulation modeling studies conducted by researchers in other states. The individual county fall:spring harvest proportions ranged as high as 18% but this generally occurred in archery only counties where spring harvests were low (< 10 birds) and the fall harvest was equally low (< 1 bird); e.g., 2007 Huntington Co., fall archery harvest 3 birds to 17 birds taken in the spring or 17.6%.

The majority (77%) of the fall harvest occurred during the combined archery/firearm portion of the season with 38% occurring on the last weekend of the combined archery/firearm portion. Shotgun hunters accounted for 67% of the total harvest with 33% taken by archers. The sex and age structure was skewed strongly towards adults of both sexes (75%) and gobblers (44%) which is not normally expected based on results of other states, except when summer production is low. Coincidental to the implementation of fall hunting in Indiana, summer production levels dropped from record high production in 2004 to a record low in 2005 and have remained below average since 2005. Another suspected factor was hunter selection for larger adult and/or male birds. Despite the low production during 2005-2008, spring harvests continued to remain high and spring hunter success remained at 21-22%.



Presumed Extirpated — Ruffed grouse believed extirpated since or prior to 1983.

Possibly Extirpated — Ruffed grouse occurred in 1983 and there is some possibility of rediscovery although presence has not been verified in last 5 years or more.

Critically Imperiled — At very high risk of extirpation within 10 years due to extreme rarity, very steep declines, or other factors .

Imperiled — At high risk of extirpation within 10 years due to low population levels, steep declines, or other factors.

Vulnerable — At moderate risk of extirpation due to relatively low populations, declining population trends, or other factors.

Apparently Secure — Uncommon but not rare; some cause for long-term concern due to declining or unstable population trends or other factors.

Secure — Common, widespread, abundant and provisions for future habitat creation assured.

SEB 9.29.08

Fall Wild Turkey Season

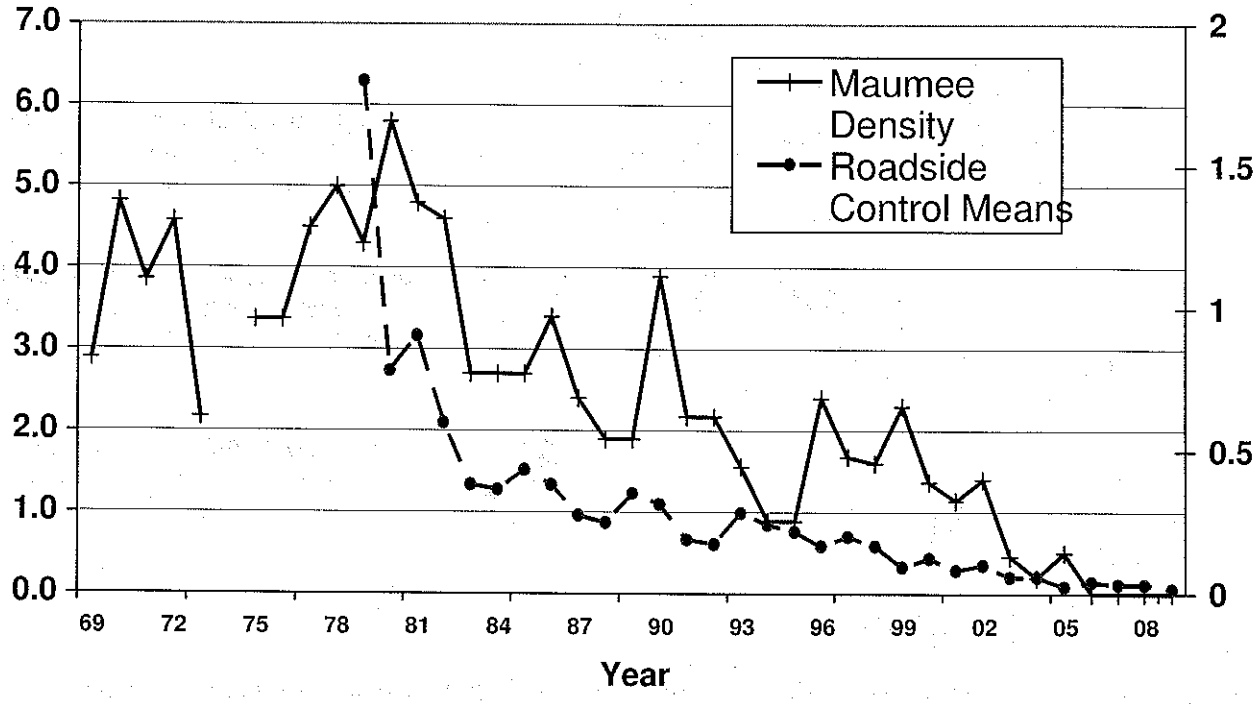
The fall season for wild turkeys was implemented in 2005 with a conservative season structure that was to be evaluated 3-5 years before significant changes were made beyond the annual county designations. Four years of fall hunting (2005-2008) have provided data under the license structure, turkey population levels, landscape and other competing fall recreation traditions in Indiana.

through either man-made disturbances (i.e. timber harvests) or catastrophic events (tornadoes, etc.) which the Division of Fish and Wildlife does not have complete control, ruffed grouse could become extirpated in Indiana.

The DNR must continue to advocate the need for timber harvests to increase habitat for depressed ruffed grouse populations and also take visible action to reduce possible or perceived negative impacts on the grouse populations. While the DNR recognizes that regulated hunting may not have long term impacts on grouse populations when habitat conditions are good, the DNR cannot say the same when habitat conditions are deteriorating and grouse populations are depressed.

Without this change in the season length and an increase in the ruffed grouse population, the DNR may have to propose a reduction in the season across the range irrespective of ownership or close the season entirely.

Figure 1. Indiana Grouse Population Trends



Grouse hunting, like many other types of small game hunting, is generally considered self-regulating as hunter numbers tend to follow the trends in the grouse population levels. A similar trend is seen in Indiana's grouse hunter and harvest trends with respect to grouse population levels. A gradual decline in both grouse hunters and harvests began after a grouse population peak in the early 1980's when around 17,000 grouse hunters harvested around 20,000 grouse. In examining 25 years of grouse harvest data in Indiana, Backs in 2001 indicated it was conceivable that if grouse habitat in the existing grouse range improved (e.g. 1980 conditions), Indiana could support harvests of at least 20,000 grouse and provide a satisfactory opportunity for at least 25,000 hunters expending 130,000+ hunter-days annually.

While declining ruffed grouse populations are directly related to deteriorating habitat caused by advancing forest succession, it is debatable whether much of an annual grouse surplus exists after the fall grouse dispersal period, especially on public lands with the least amount of active timber management but the most readily accessible by hunters. The fall dispersal period for ruffed grouse in Indiana begins in early September, peaking by early October, with most of the dispersal movement completed by the end of October. The fall dispersal period is a period of high grouse mortality, primarily juveniles. Studies to assess the potential impacts of hunting on grouse suggest that when harvest mortality coincides with dispersal, it tends to be compensatory but mortality after dispersal begins to shift towards additive mortality, possibly removing potential breeders.

Game Bird Habitat Revenue

Revenue from the sale of game bird habitat stamps can be used for the purpose of restoring the habitat of various game birds in Indiana, including habitat for pheasants, quail, grouse, mourning doves, and wild turkeys (IC 14-22-8). This revenue has been used to help restore game bird habitat on private property as well as for land acquisitions that will benefit game bird populations.

Reducing the bag limit

A final alternative suggestion might be to reduce the current bag limit from 2 birds to 1 bird. For the past two decades, the average grouse hunter is harvesting < 1 bird/hunter/season (estimated 0.16 birds/hunter/season in 2005). Such an alternative would be superficial with no meaningful effect except to deny some lucky guy, more than likely hunting with a buddy, who on a rare day has the opportunity to kill two grouse. Reducing the bag to one bird would create the perception (albeit false) primarily among the non- active grouse hunters and the general public, that the agency is taking a more aggressive approach to reducing potential hunting impacts on ruffed grouse.

Not changing the hunting season

The DNR Division of Fish and Wildlife believes that some action is needed due to the continued decline in grouse numbers and deteriorating habitat. While it is acknowledged that the proposed shortening of the grouse season will not result in an increase in grouse numbers on public lands, it will demonstrate the DNR's responsible stewardship and concern for the future of this resource. The DNR's Division of Fish and Wildlife is required by law to provide for the protection and conservation of wild animal populations in Indiana, including that of ruffed grouse. If the DNR fails to take some type of action, and there is no disturbance of forests

Declining Habitat Conditions

Prospects for population recovery are poor given the continual advancement of forest succession. Ruffed grouse habitat is primarily dense, early successional stages of hardwoods or "young forests" that are disappearing from the major forest tracts in Indiana and the eastern United States. Early seral stages of hardwoods (seedling/sapling/pole size classes) are an integral component of the breeding habitat for ruffed grouse. A population model analysis for ruffed grouse in Indiana projects that ruffed grouse will not exist at viable population levels by 2014 on the Hoosier National Forest under current trends in forest succession and management. Based on similar trends in grouse populations, forest succession, and land management, a parallel fate probably faces ruffed grouse on adjacent public and private forestlands in south-central Indiana. The Knob's sampling unit of the Continuous Forest Inventory for Indiana generally covers the primary distribution of ruffed grouse in south-central Indiana. The proportion of seedling/sapling and pole timber components have progressively declined ($\geq$ 65% since 1967) as the forests have matured with the structure shifting into larger, more open saw log-sized forests.

Historical Grouse Hunting Season Structure

Historically, Indiana's grouse season was only 2-3 weeks from 1965 to 1971 before it was extended to 8 weeks in 1972. In 1980, when grouse populations were increasing both in numbers and distribution, the season was extended to 15 weeks. In 1992, the grouse season was shifted earlier to October first and reduced to 13 weeks due primarily to deteriorating habitat conditions but also a significant increased hunter effort/harvest during the late January season.

Since the number of hunters who actively pursue ruffed grouse in Indiana has declined significantly in the last two decades, the impact on the general hunting public is minimal. The enforcement of the regulation could cause problems where there is over lap of public and private ownerships but would be minimal, especially with so few grouse hunters. Differential hunting regulations for public and private land are not without precedent (e.g., landowner license exemption, bonus antlerless deer licenses, trapping, hunting rabbits).

Grouse trapping and wild turkey trade programs

During 1966-91 (25 years) 5,460 birds were trapped; 3,942 (72%) going out-of-state as part of the 3 grouse:1 turkey trade agreements with other states; 1,417 (26%) grouse were transplanted in 22 counties of Indiana as part of our grouse restoration program; 101 (<2%) died in transit. Of the 4,554 grouse trapped during 1977-91, 2,240 (49%) were trapped on lands not open to public hunting (Brown County State Park, Crane Naval Base). During 1977-91, the 4,554 grouse trapped represented 3% of the estimated 147,317 grouse harvested by grouse hunters in Indiana during the same period. The proportion trapped (3%) is considerably less than the reported 11-13% annual crippling losses for grouse hunters.

Hunting Mortality

Generally, hunting mortality of gamebirds can range from compensatory to additive depending on the relative population level of the species, nature of the habitat (quality, quantity, and spatial distribution), the amount of hunting pressure, seasonal timing, and in some cases the availability of alternative (buffer) prey (gamebird) species.

ruffed grouse is open in only 25 counties in 3 regions in Indiana, and there was an insufficient amount of data to calculate any regional harvest parameters, with the exception of the south-central region. The south-central region had an estimated 1,183 grouse hunters, and accounted for 77.5% (93 ruffed grouse) of the total ruffed grouse harvest. Hunters in the south-central region of the state had a success rate of 0.04 ruffed grouse per day of hunting effort. The average ruffed grouse hunter in Indiana spent 1.84 days in the field (+32.0% from 2005-2006) and harvested 0.08 grouse (–45.9% from 2005–2006) during the 2008-2009 season. During the 2005-2006 season, an estimated 1.2% of resident license holders and 1.7% of resident small game hunters hunted ruffed grouse. An estimated 2,083 grouse hunters harvested an estimated 331 ruffed grouse during the 2005–2006 season. In comparison to results from legal counties during the 2003-2004 season, the number of ruffed grouse hunters in the state decreased 24.3%, and the estimated total harvest declined by 20.0%.

The DNR does not believe that this rule change will have any measurable affect on the sale of hunting licenses and game bird habitat stamps in Indiana. The DNR believes that there are already very few individuals who hunt ruffed grouse in Indiana, and those who do probably already purchase a license to hunt other species. The game bird habitat stamp is required to hunt quail, pheasants, grouse, mourning doves, and wild turkeys, so this rule change is not likely to impact the sale of these stamps.

Population Status

Ruffed grouse breeding populations are at extremely low levels. The 2009 drumming index for 8 survey control routes was 0.02 drumming males heard per stop (1 drummer heard/ 50 stops), less than 2% of levels recorded during the peak years of 1979-81 (Figure 1). The 5-year mean drumming index (2005-2009) was 0.03 drummers per stop or approximately 1 drummer heard every 33 stops. For the fifth consecutive year, no drumming activity centers were located on the Maumee Grouse Study Area where population monitoring began in the early 1960's. Grouse populations rangewide, especially density levels, are at historically recorded lows. No drumming males were heard on the 10 roadside survey routes (15 stops/route) during the 2010 survey period. In 2009, 0.02 drumming males heard per stop on the 8 control routes. The 5-year (2006-2010) mean drumming index for the control routes was 0.02 drummers per stop (~1 drummer heard every 50 stops) which was <2% of levels recorded during the peak years of 1979-81.

The distribution of ruffed grouse in Indiana has historically fluctuated with changing land use. In 1931, ruffed grouse occurred in only 12 counties. Following reforestation, natural range expansion and successful restoration efforts, the grouse distribution expanded to 41 counties in 1983, the widest distribution since 1856. A reassessment of grouse distribution in Indiana was initiated in 2008 using reports of ruffed grouse made during the last 5 years. Compared to the 1983 distribution, it is highly probable that ruffed grouse are now extirpated from 15 counties and likely to exceed 25 counties within a few years if no major forest disturbance occurs. Preliminary data from the Indiana Breeding Bird Atlas (2005-2010) indicate ruffed grouse occurred in less than 1% of the priority blocks surveyed compared to 10% for the same blocks during the 1985-1990 atlas.

DNR RESPONSE

Ruffed Grouse

Ruffed Grouse hunting currently occurs across all or portions of 25 counties from the first of October to December 31 (13 weeks) with a 2 bird bag limit.

Extremely low grouse population levels and deteriorating habitat conditions with uncertain prospects for improvement raise concerns about hunting mortality on grouse populations, especially on public lands with unrestricted hunter access. While grouse hunting demand has declined in response to decreased population levels, it is debatable whether or how much of a "harvestable surplus" exists after the fall dispersal period. Timber harvests creating young forest habitats are still occurring to some degree on private ownerships where hunter access is restricted. The proposed rule change to shorten the grouse season on public lands to coincide with the fall dispersal period would reduce concerns about the over-harvest of potential breeders where hunter access is not limited.

The proposed rule change would not reduce private land opportunities, nor penalize those landowners who actively manage their woodlands to produce young forest habitats for ruffed grouse and provide an incentive to landowners, who enjoy grouse hunting, to more actively manage their timberlands. The shortened grouse season on public lands would overlap with the first part of the small game season and the peak migration flights of American woodcock, a compatriot game species often sought by grouse hunters.

The goal of the National Ruffed Grouse Conservation Plan and the Indiana DNR is to bring ruffed grouse back to 1980 levels; please see the attached Ruffed Grouse Conservation Plan Executive Report.

Representatives from the DNR's Divisions of Forestry and Fish and Wildlife, as well as from the Ruffed Grouse Society and Hoosier National Forest, met several times in 2008 to discuss management for ruffed grouse and steps that need to be taken to improve their population in Indiana. Attached please find the summary report of those meetings. Since the report was prepared, the DNR has re-assessed the current distribution and conservation status of ruffed grouse in Indiana, established Indiana's core grouse area, provided testimony to the Natural Resources Study Committee of the Indiana General Assembly in 2009 regarding needed habitat management, continued to monitor grouse populations through surveys, provided technical comments in reviews of land management proposals for the Hoosier National Forest with a strong emphasis on the habitat needs of ruffed grouse and other wildlife using young forest habitats, as well as provided technical support to DNR's Division of Forestry personnel.

According to the latest small game harvest survey, an estimated 0.8% of license holders and 1.1% of small game hunters pursued ruffed grouse in Indiana during the 2008-2009 season. Participation rates from the survey resulted in a statewide estimate of 1,555 grouse hunters and a harvest estimate of 120 ruffed grouse during the 2008-2009 season. In comparison to grouse hunting in the designated counties during the 2005-2006 season, the number of ruffed grouse hunters in the state declined 31.1% and the estimated total harvest declined 62.7%. Hunting of

"Exhibit D"

TITLE 312 NATURAL RESOURCES COMMISSION

Final Rule
LSA Document #09-984(F)

DIGEST

Amends 312 IAC 9-4-10 by reducing the length of the ruffed grouse hunting season on public land. Amends 312 IAC 9-4-11 by modifying the dates of the fall season for hunting wild turkeys, adding counties where wild turkeys may be hunted during the fall season, and adding a hunter orange requirement for hunting during the fall season that coincides with deer muzzleloader season. Effective 30 days after filing with the Publisher.

IC 4-22-2.1-5 Statement Concerning Rules Affecting Small Businesses

312 IAC 9-4-10; 312 IAC 9-4-11

SECTION 1. 312 IAC 9-4-10 IS AMENDED TO READ AS FOLLOWS:

312 IAC 9-4-10 Ruffed grouse
Authority: IC 14-10-2-4; IC 14-22-2-6
Affected: IC 14-22

Sec. 10. (a) An individual may hunt ruffed grouse (Bonasa umbellus) only from:
(1) October 1 through December 31 **on privately owned lands; and**
(2) October 1 through November 10 or the first Friday after November 10, whichever is later, on publicly owned lands.

(b) An individual may take two (2) ruffed grouse per day.

(c) An individual must not hunt ruffed grouse except in the following counties:
(1) Bartholomew.
(2) Brown.
(3) Clark.
(4) Crawford.
(5) Dearborn (south of U.S. 50).
(6) Greene (east of U.S. 231).
(7) Jackson.
(8) Jefferson.
(9) Jennings (south of U.S. 50).
(10) Johnson.
(11) LaGrange (except Pigeon River Fish and Wildlife Area).

(12) Lawrence.
(13) Martin.
(14) Morgan.
(15) Monroe.
(16) Ohio.
(17) Orange.
(18) Owen.
(19) Putnam (south of U.S. 40).
(20) Perry.
(21) Ripley (south of U.S. 50).
(22) Scott.
(23) Steuben (except Pigeon River Fish and Wildlife Area).
(24) Switzerland.
(25) Washington.

(Natural Resources Commission; 312 IAC 9-4-10; filed May 12, 1997, 10:00 a.m.: 20 IR 2710; readopted filed Jul 28, 2003, 12:00 p.m.: 27 IR 286; readopted filed Nov 24, 2008, 11:08 a.m.: 20081210-IR-312080672RFA; filed Mar 12, 2010, 1:28 p.m.: 20100407-IR-312090479FRA)

SECTION 2. 312 IAC 9-4-11 IS AMENDED TO READ AS FOLLOWS:

312 IAC 9-4-11 Wild turkeys

Authority: IC 14-10-2-4; IC 14-22-2-6
Affected: IC 14-22-11-1; IC 14-22-11-11; IC 35-47-2

Sec. 11. (a) Except as provided in subsection (c), an individual may hunt wild turkeys (Meleagris gallopavo) in the spring from the first Wednesday after April 20 and continuing for an additional eighteen (18) consecutive days.

(b) An individual may hunt wild turkeys (Meleagris gallopavo) during the fall as follows:

(1) With firearms **as follows:**

(A) From the first Wednesday after October 14 and continuing for an additional four (4) consecutive days ~~and~~ **in the following counties only:**

(i) Dekalb.
(ii) LaGrange.
(iii) LaPorte.
(iv) Marshall.
(v) St. Joseph.
(vi) Starke.
(vii) Steuben.

(B) From the first Wednesday after October 14 and continuing for an additional eleven (11) consecutive days in the following counties only:

(i) Bartholomew.
(ii) Brown.
(iii) Clark.

(iv) Clay
(v) Crawford.
(vi) Daviess.
(vii) Dearborn.
(viii) Dubois.
(ix) Fayette.
(x) Floyd.
(xi) Fountain.
(xii) Franklin.
(xiii) Gibson.
(xiv) Greene.
(xv) Harrison.
(xvi) Jackson.
(xvii) Jefferson.
(xviii) Jennings.
(xix) Knox.
(xx) Lawrence.
(xxi) Martin.
(xxii) Monroe.
(xxiii) Morgan.
(xxiv) Ohio.
(xxv) Orange.
(xxvi) Owen.
(xxvii) Parke.
(xxviii) Perry.
(xxix) Pike.
(xxx) Posey.
(xxxi) Putnam.
(xxxii) Ripley.
(xxxiii) Scott.
(xxxiv) Spencer.
(xxxv) Sullivan.
(xxxvi) Switzerland.
(xxxvii) Union.
(xxxviii) Vanderburgh.
(xxxix) Vermillion.
(xl) Vigo.
(xli) Warren.
(xlii) Warrick.
(xliii) Washington.

(2) With a bow and arrows from:

(A) October 1 to the end of the fall turkey season with firearms ~~except as provided~~ **as established** in subsection ~~(c).~~ **(b)(1); and**

(B) the first Saturday after the closing day of deer firearms season as established in 312 IAC 9-3-4(e) through the first Saturday in January.

(c) The spring and fall seasons for hunting and possessing wild turkeys on Camp Atterbury shall be determined by the director on an annual basis to prevent interference with military training exercises.

(d) An individual may take one (1):
(1) bearded or male wild turkey during the spring season; and
(2) wild turkey of either sex during the fall season.

(e) An individual must not do the following:
(1) Hunt wild turkeys except between one-half (1/2) hour before sunrise and sunset.
(2) Take a wild turkey except with the use of one (1) of the following:
(A) A shotgun or muzzleloading shotgun:
(i) not smaller than 20 gauge; and
(ii) not larger than 10 gauge;
loaded only with shot of size 4, 5, 6, 7, or 7 1/2.
(B) A bow and arrows, including crossbows as defined in 312 IAC 9-3-4(g), with the following restrictions:
(i) An individual must not use a:
(AA) long bow; or
(BB) compound bow;
of less than thirty-five (35) pounds pull.
(ii) Arrows must be equipped with metal or metal-edged (or flint, chert, or obsidian napped) broadheads.
(iii) An individual must not use a:
(AA) crossbow of less than one hundred twenty-five (125) pounds pull;
(BB) crossbow without a mechanical safety; or
(CC) poisoned or explosive arrow.
(iv) No portion of a bow's riser (handle) or:
(AA) track;
(BB) trough;
(CC) channel;
(DD) arrow rest; or
(EE) other device;
that attaches to the bow's riser shall contact, support, or guide the arrow from a point rearward of the bow's brace height.
~~(v) Before or after lawful shooting hours, an individual must not possess a:~~
~~(AA) long bow;~~
~~(BB) compound bow; or~~
~~(CC) crossbow;~~
~~in the field if the nock of the arrow is placed on the bow string.~~
(3) Hunt wild turkeys in the fall season ~~except in a county the director designates on an annual basis by temporary rule.~~ **that takes place during the deer**

muzzleloader season as established in 312 IAC 9-3-4(f) unless that individual wears hunter orange.

(f) The special youth season for hunting wild turkeys under this subsection is two (2) consecutive days beginning on the Saturday immediately before the start of the spring turkey season established in subsection (a). As used in this subsection, "youth" means an individual who is less than eighteen (18) years of age on the date of the hunt. A youth who hunts a wild turkey under this section must be accompanied by an adult who is at least eighteen (18) years of age. An adult accompanying a youth hunter must not possess a firearm, bow and arrow, or crossbow while in the field. The seasonal limit for hunting **wild** turkeys under this subsection is one (1) bearded or male wild turkey. A youth hunter who takes a wild turkey under this subsection must not take another wild turkey during the spring turkey season in the same year.

(g) An individual must not use or possess:
(1) a dog;
(2) another domesticated animal;
(3) a live decoy;
(4) a recorded call;
(5) an electronically powered or controlled decoy; or
(6) bait;
while hunting a wild turkey. An area is considered baited for ten (10) days after the removal of the bait, but an area is not considered to be baited that is attractive to wild turkeys resulting from normal agricultural practices.

(h) An individual must not possess a handgun while hunting wild turkeys or while accompanying the youth hunter during the season established in subsection (f) unless the individual possesses a handgun in accordance with IC 35-47 and:
(1) has a valid unlimited license to carry a handgun issued under IC 35-47-2-3;
(2) has a valid unlimited license to carry a handgun recognized under IC 35-47-2-21(b); or
(3) is not required to possess a license to carry a handgun under IC 35-47-2-2.

(i) Except as provided under IC 14-22-11-1 and IC 14-22-11-11, an individual must not hunt:
(1) wild turkeys unless possessing a completed and signed license bearing the individual's name; or
(2) with a wild turkey license issued to another individual.

(j) An individual may take a wild turkey during the spring season established under subsection (a) only if:
(1) issued a license to hunt wild turkeys with:
(A) a resident youth consolidated hunting license under IC 14-22-11-10(b);
(B) a resident spring turkey license under IC 14-22-11-10(a) or IC 14-22-12-1(a)(20);

(C) a nonresident spring turkey license under IC 14-22-12-1(a)(21);
(D) a resident youth consolidated hunting license under IC 14-22-12-1(a)(24);
(E) a nonresident youth spring turkey license under IC 14-22-12-1(a)(27);
(F) a lifetime comprehensive hunting license under IC 14-22-12-7(a)(4);
(G) a lifetime comprehensive hunting and fishing license under IC 14-22-12-7(a)(5); or
(H) an apprentice spring turkey hunting license under IC 14-22-12-1.7; or
(2) hunting under IC 14-22-11-1.

(k) An individual may take a wild turkey during the fall season established under subsection (b) only if:
(1) issued a license to hunt wild turkeys with:
(A) a resident youth consolidated hunting license under IC 14-22-11-10(b);
(B) a resident fall turkey license under IC 14-22-11-10(a) or IC 14-22-12-1(a)(22);
(C) a nonresident fall turkey license under IC 14-22-12-1(a)(23);
(D) a resident youth consolidated hunting license under IC 14-22-12-1(a)(24);
(E) a nonresident youth fall turkey license under IC 14-22-12-1(a)(28);
(F) a lifetime comprehensive hunting license under IC 14-22-12-7(a)(4);
(G) a lifetime comprehensive hunting and fishing license under IC 14-22-12-7(a)(5); or
(H) an apprentice fall turkey hunting license under IC 14-22-12-1.7; or
(2) hunting under IC 14-22-11-1.

(l) Immediately after taking a wild turkey, an individual must attach a piece of paper to a leg of the turkey directly above the spur stating the following:
(1) The name and address of the individual who took the ~~wild~~ turkey.
(2) The license number (if applicable) of the individual who took the ~~wild~~ turkey.
(3) The date the wild turkey was taken.
(4) The sex of the wild turkey taken.

(m) An individual who takes a wild turkey must do the following:
(1) Cause delivery of the wild turkey to an official turkey checking station within forty-eight (48) hours of taking.
(2) Register the wild turkey in the name of the individual who took the wild turkey.
(3) Provide the check station with true and accurate information, including the name and license number of the individual who took the wild turkey and the date the wild turkey was taken.
(4) Receive the permanent seal after the checking station operator:
(A) records the permanent seal number on the log; and
(B) collects the piece of paper described in subsection (l).
(5) Immediately and firmly affix the seal to the leg of the wild turkey as follows:

(A) On the leg of a wild turkey for a wild turkey taken during the spring season.

(B) Through a section of skin or flesh to prevent its removal (without cutting the seal or the body part to which it is affixed) for a wild turkey taken in the fall season.

The permanent seal must remain affixed until processing of the wild turkey begins.

(n) The official wild turkey checking station operator shall accurately and legibly complete all forms provided by the department and make those forms available to department personnel on request.

(o) The feathers and beard of a wild turkey must remain attached while the wild turkey is in transit from the site where taken.

(p) As used in this section, "bait" means to:
(1) place;
(2) expose;
(3) deposit;
(4) distribute; or
(5) scatter;

grain, salt, or other feed to lure, attract, or entice a wild turkey to an area where a person may take the wild turkey. *(Natural Resources Commission; 312 IAC 9-4-11; filed May 12, 1997, 10:00 a.m.: 20 IR 2710; filed May 28, 1998, 5:14 p.m.: 21 IR 3715; filed Dec 26, 2001, 2:40 p.m.: 25 IR 1533; readopted filed Jul 28, 2003, 12:00 p.m.: 27 IR 286; filed Sep 23, 2004, 3:00 p.m.: 28 IR 541; filed May 25, 2005, 10:15 a.m.: 28 IR 2946; filed Jun 23, 2006, 2:24 p.m.: 20060719-IR-312050214FRA; filed Jan 8, 2007, 9:11 a.m.: 20070207-IR-312060193FRA; filed Sep 6, 2007, 12:20 p.m.: 20071003-IR-312070023FRA; readopted filed Nov 24, 2008, 11:08 a.m.: 20081210-IR-312080672RFA; filed Apr 3, 2009, 1:48 p.m.: 20090429-IR-312080740FRA; filed Mar 12, 2010, 1:28 p.m.: 20100407-IR-312090479FRA)*